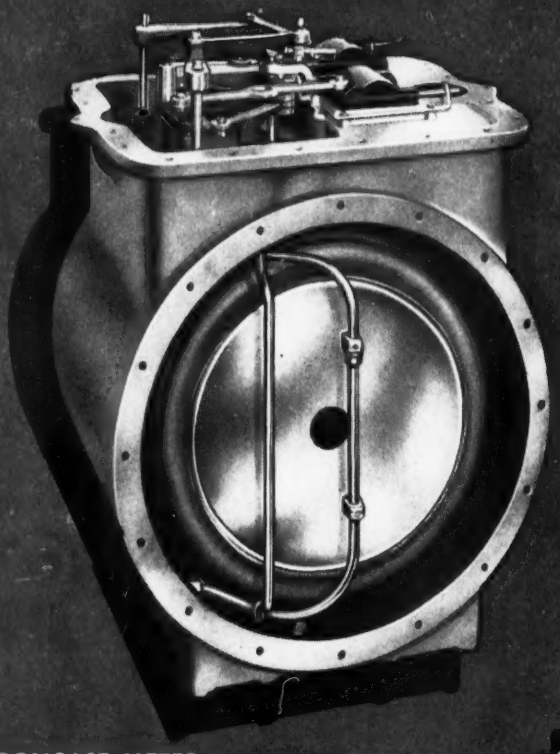
American
1859 Centennial Year 1959
Gas Journal
ONLY MAGAZINE EDITED EXCLUSIVELY FOR THE GAS DISTRIBUTION INDUSTRY
MARCH 1959

CORROSION REPORT

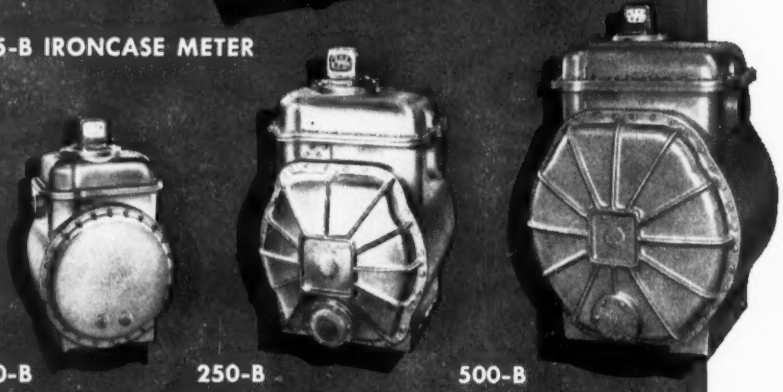
Save Money on Hot-Spot Protection
Corrosion Detection with Ultrasonics
Corrosion Rate Index for 500 U. S. Cities

RG&E Finds Tough Construction Jobs Made Easier by Good Public Relations

MAKING THE BEST BETTER THAN EVER!



35-B IRONCASE METER



80-B 250-B 500-B

AMERICAN METER CO.

AMERICAN® METER COMPANY

INCORPORATED (ESTABLISHED 1836)

General Offices: Philadelphia 16, Pa.

Sales offices in principal cities

American® high capacity Ironcase Meters with

DURAMIC DIAPHRAGMS—molded, 3-convolution design for all fuel gas services.

REINFORCED FLAG RODS—insure positive alignment and sustained accuracy.

GROMMET SEALS—on flag rods provide minimum friction.

American high capacity Ironcase and Aluminumcase meters now incorporate these latest design advances for handling the big loads accurately and economically.

Sustained accuracy is built into these meters with the many refinements developed by American in over 120 years of meter engineering.

- Rated capacities to 10,000 cfh — 0.60 sp. gr. gas.
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GEM

SUPPLIERS TO THE GAS INDUSTRY for Ironcase, Tinned Steelcase, Aluminumcase and Welded Steelcase Meters • American-Westcott Orifice Meters • Instruments • Reliance Regulators • Apparatus • Valves

1859 1959
CENTENNIAL YEAR

American Gas Journal

ONLY MAGAZINE EDITED EXCLUSIVELY FOR THE GAS DISTRIBUTION INDUSTRY

Volume 186 MARCH 1959 Number 3

PILOT.. ..LIGHTS

Eh?

Sounds you can't hear are being put to work measuring internal corrosion of pipe and of steel plate in LPG storage tanks and gas holders. Key to the new method is *ultrasonic energy* — sounds in the range of 15,000 to 100,000 cycles per second, above the hearing ability of the human ear. Ultrasonics, in addition to the methods described in the article on page 20, are also being used to check internal discontinuities in welded fabrications and for cleaning all kinds of products. The ultrasonics industry has grown rapidly in the past 15 years and many of the devices developed by it are now finding their way into use by the gas distribution industry. This is the first of several reports that will appear in AGJ.

*

How Does Your City Rate?

Atmospheric Corrosion — and how rapidly it can take place — is the subject of a special presentation this month that gives the "corrosion rate index" for 523 U. S. cities. The complete index, result of a 25-year extensive research program, is based on the time it takes a 28-gage steel plate to corrode to a severe degree when exposed to atmospheric conditions — rain, wind, sun, air pollution, etc. As has been long suspected, the fastest rate occurs in the nation's major industrial areas.

*

Hot Spots

No successful corrosion mitigation program for a gas distribution system can ignore providing adequate protection for gas service lines. One very useful and economical method of providing such protection is to apply "hot spot" protection — it can cost as little as 15% of a full-scale program and still provide 90% protection.

*

Next Month

Progress thrives on ideas — totally new ideas or even simple but previously unrecognized ways of doing a job better. In April, AGJ brings you a special section of "Ideas at Work" — ideas from around the nation being used by various gas distribution companies to save dollars and minutes.

*

Editorial Index Now Available

Readers desiring a copy of the annual index to Volume 185 (January-December 1958) of AGJ can obtain a copy by writing to: *Department AI, American Gas Journal, Box 1589, Dallas 21, Texas.* Be sure to address your request to this department so that it will receive prompt attention.

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New device makes possible accurate detection of internal pipe corrosion by external means

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Corrosion Rate Index of 523 U.S. Cities 24
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Hot Spot Protection Can Save You Money 26
Up to 90 percent protection against leaks at cost of only 15 percent of full protection program possible by guarding against "hot spots"

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Northern Illinois Gas Company corrosion engineers find new accessory a valuable time saver in making corrosion studies

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Protection of service lines is important part of overall corrosion mitigation program; here's a checklist of suggested methods

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you specify

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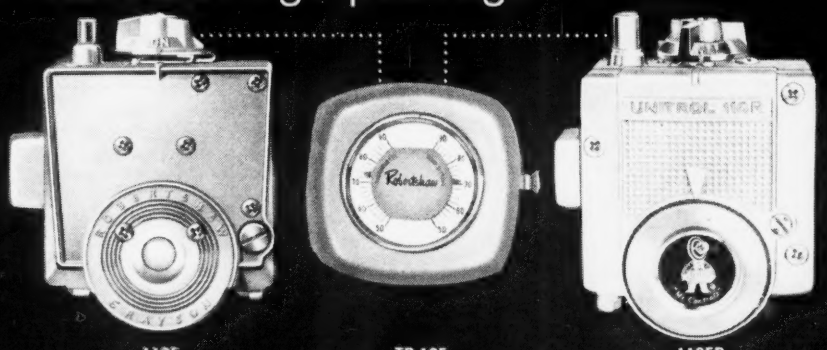
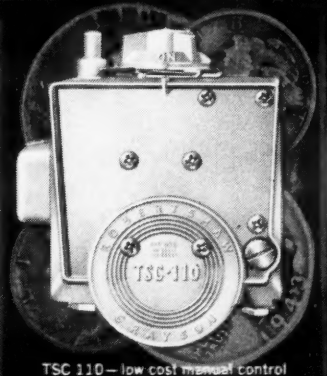
your savings show up here

✳ a NEW savings package

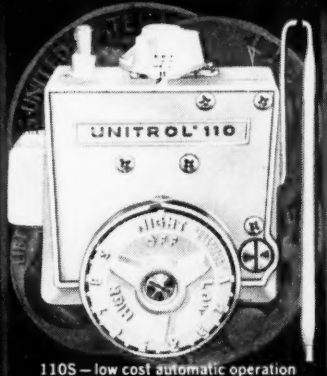
✳ Announcing the new 110E (24 Volt, low cost electric space heater control) and the 110E-R (same as the 110E except with gas pressure regulator added), either to be used with the TR125 Wall Thermostat.



110E TR-125 110ER



TSC 110—low cost manual control



110S—low cost automatic operation

110SR—low cost automatic operation with gas pressure regulator

...a complete selection of reliable low-cost space heater controls

Robertshaw-Fulton
CONTROLS COMPANY

GRAYSON CONTROLS DIVISION · LONG BEACH, CALIFORNIA

INDIANA
MAR 2 5 1959

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1859 1959

MCF

NEWS HILITES OF THE INDUSTRY

Gas consumers in Pennsylvania and bordering states will pay more for gas if coal interests on the state's coal-minded tax commission have their way. The Pennsylvania commission has recommended a tax of 1/12 of 1-cent per month on each Mcf of gas stored underground in the Keystone commonwealth. Suggested tax is part of new program to raise $425,000,000 in new revenues. By way of contrast, the governor's tax committee — which includes Thomas Kennedy, vice president of the United Mine Workers, and Thomas Love, chairman of Pittsburgh's Consolidation Coal Company, as members — has recommended that no new taxes be levied on coal. Companies who would feel the tax most include major gas transmission firms such as New York State Natural Gas, Tennessee Gas, Texas Eastern, and Manufacturers Light and Heat. The tax undoubtedly would be passed on to gas distribution company customers of the transmission companies and the utilities, in turn, would pass it on to their customers.

Soviet haste to be "first on the moon" might be explained by a broadcast on Moscow Radio, monitored by United Press International, that quotes Soviet scientist Nikolai Kozyrev as declaring that there may be oil and natural gas on the moon. Professor Kozyrev is reported to have done research indicating that the pockmarked surface on the lunar body has "many exits of natural gas." (At latest report, the FPC had not received any requests for permission to build a pipeline to the moon and import the gas.)

Less than three percent of U. S. building fires were attributed to gas and gas appliances in 1957 according to National Fire Protection Association annual estimates. Gas was listed as cause in only 22,800 of a total 843,900 fires, and was charged with only about two percent of fire losses — $28,600,000 of a total $1,068,000,000.

Increased use of coal and less use of gas as "boiler fuel" for electric generating plants may result from major research program being sponsored jointly by the electric utility industry and the coal industry. Use of natural gas to fire boilers has long been considered an inferior use of the valuable fuel, even though it serves to maintain year-around load factors for many gas companies —usually on an interruptible basis.

Right-of-way problem for Houston Texas Gas & Oil's new gas transmission line has been buried by the Florida State Turnpike Authority. For $270,000, the authority will allow the company to construct an 18-in. line along the 108-mile route of the toll road, buried to a 4-ft depth. Sum is equal to one month's net revenue of the Sunshine State Parkway.

Power From Sewage Gas. In New Delhi, India, engineers are considering use of gas produced by the city's three sewage treatment plants to generate electricity. An estimated 2,500,000 cu ft could be produced from sewage plants. Possibility of utilizing the now almost totally wasted gas to produce carbon black, now imported, is also being studied.

Can the FPC authorize new gas sales by independent producers without first approving the rates to be charged? No less an authority than the U.S. Supreme Court will have a voice in the answer; the highest court has agreed to review a lower court decision — involving Tennessee Gas, independent producers selling gas produced offshore, the New York State PSC, and eastern gas distributors — concerning FPC's right to approve contracts without attaching initial rate conditions. In this case, the lower court had ruled against the FPC. The court earlier agreed to review another lower court ruling that the FPC, while having authority to impose rate conditions on new sales by independent producers, was not obliged to do so if it believed the public interest was being served.

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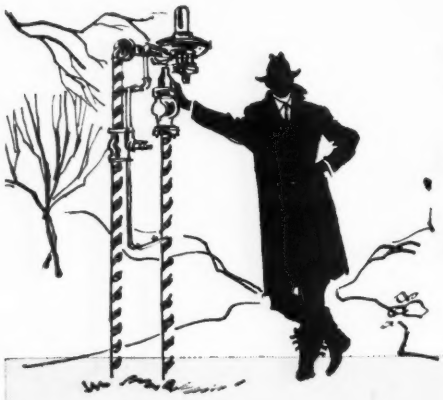

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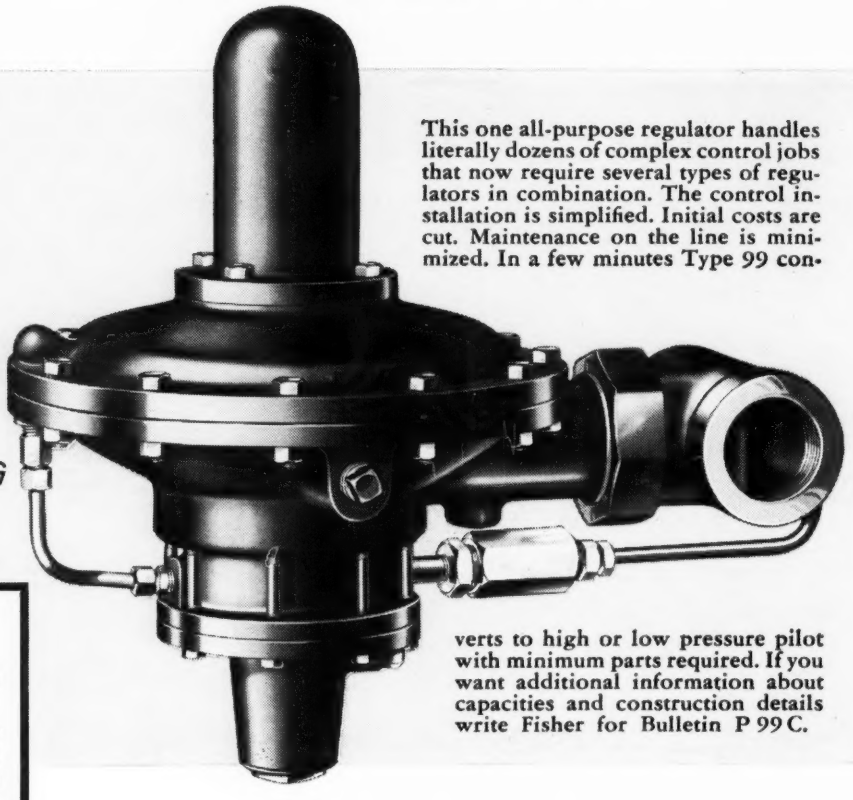
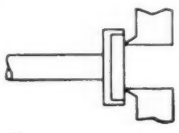
MULTI-PURPOSE PRESSURE REDUCING GAS REGULATOR

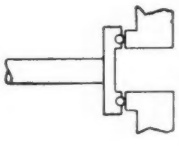


This one all-purpose regulator handles literally dozens of complex control jobs that now require several types of regulators in combination. The control installation is simplified. Initial costs are cut. Maintenance on the line is minimized. In a few minutes Type 99 converts to high or low pressure pilot with minimum parts required. If you want additional information about capacities and construction details write Fisher for Bulletin P 99C.

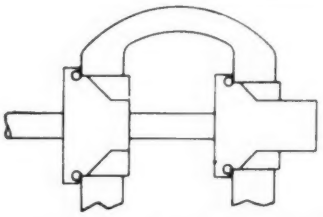
ORIFICE SIZES— INNER VALVE STYLES



⅞" Composition Disc Single Port. Max. Inlet 250 psi. 1⅛" Composition Disc Single Port. Max. Inlet 150 psi.



⅞" "O" Ring Single Port. Max. Differential 250 psi. 1⅛" "O" Ring Single Port. Max. Differential 250 psi. (with heavy main spring) 2" "O" Ring Single Port. Max. Differential 40 psi.



2" "O" Ring Double Port. Max. Differential 100 psi.

1. **The factory pre-set spring provides powerful lock-off action.**
2. **Large, effective area of main diaphragm in combination with relay pilot assures trouble-free accuracy.**
3. **It is only a matter of minutes and a minimum of parts to convert to high or low pressure pilot.**
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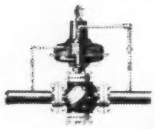
5. **Composition valve disc assures tight shutoff on zero flow and excellent regulation from low flow to maximum capacity.**



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MEN AT WORK

IN THE GAS DISTRIBUTION INDUSTRY

W. M. Kinley

L. C. Swing

● **Walter M. Kinley** and **Leonard C. Swing** have been promoted to vice presidents of Hope Natural Gas Company. Kinley, former executive assistant to the president, will serve as vice president — administration and a director; Swing, former construction superintendent, will serve as vice president — engineering and a director.

● **John H. Clark** has been appointed assistant to the manager of public relations for Northern Indiana Public Service Company succeeding **Harry Gelenian** who resigned December 31.

● **Pieter Root, Jr.,** has been appointed assistant to the director of the American Gas Association Laboratories in Cleveland, Ohio. He was previously assistant manager of the Pacific Coast Branch of the A.G.A. labs.

● **Lynn McGuffy Company, Inc.** has been appointed sales representatives of the Industrial Silencer Division of Burgess-Manning Company and will handle sales of B-M snubbers for elimination of pulsation in gas pipeline systems and excessive intake and exhaust noise from internal combustion engines, compressors, blowers, etc.

● Five promotions have been announced recently in the engineering and development division and the central district, street division of Boston Gas Company. In engineering and development, **Marshall S. David** has been named engineer; **Donald L. Goodick,** assistant engineer; and **Lawrence E. Crockett,** development engineer. In the central district, street division, **Vincent D. Cox** has been named superintendent and **Richard A. Bleakney,** assistant superintendent.

● **Robert C. Heid** has been named assistant senior engineer in the gas engineering department of Columbia Gas System Service Corporation at Columbus, Ohio.

● L. B. Foster Company has named four new sales representatives: **Leonard A. McGovern,** assigned to the New York office, will cover the Philadelphia area. **Richard P. Gurley** has been named sales administrator of the construction division of the Chicago office; **Donald J. Cier,** assigned to Los Angeles sales staff, will cover the Northwest; and **John B. Manning** will specialize in pipe sales in the Pittsburgh office.

● **Robert M. Johnson** has been appointed western regional manager of General Controls Company. He was formerly Los Angeles branch manager.

● **John F. Merriam,** president of Northern Natural Gas Company, has been elected president of the newly-formed Helex Company, a joint project of Northern Natural and Air Products, Inc. of Allentown, Pennsylvania, to extract helium from natural gas. Other officers of the new company include: **M. L. Mead,** senior vice president; **F. C. Nicholson,** vice president; **W. H. Thomas,** vice president sales; **B. H. Harper,** secretary; and **H. H. Siert,** treasurer.

● **Lester Wildman,** sales representative for Oklahoma Natural Gas Company in Norman, has been promoted to the position of general promotion representative with the company in Tulsa.

● Three Union Gas Company of Canada senior supervisory appointments have been announced recently: **Gavin H. D. Martin** has been appointed operations manager, **Edward D. Learoyd,** succeeds Martin as chief engineer, and **Ted P. Karry** has been appointed supervisor of public information.

● **Nathan H. Gellert Jr.** has been appointed president and general manager of Hood Northwest Sheet Metal Company, a subsidiary of Hood Construction Company of Whittier, California. Company operates gas appliance and equipment stores and sheet metal shops in Boise, Payette, Pocatello, and Idaho Falls.

● **Robert D. Slack** has been appointed sales representative for Midwestern Pipe Line Products Company for Iowa, Nebraska, Kansas, and Missouri. He was formerly sales engineer in the Chicago office of Walworth Company.

● **Jack R. Martin** has been promoted to sales manager, Tulsa division of Midwestern Engine & Equipment Company, Inc.

● **Daniel L. Cronin,** former Toledo district dealer sales manager of Ohio Fuel Gas Company, has been named Oberlin local agent succeeding **M. E. Vernon** who was recently promoted to Sandusky local manager. Four other recent personnel changes in O-F's distribution department include the retirement of **I. A. Ludwig,** vice president and Toledo district manager from active participation in operation of the Toledo district. **H. C. Taylor,** Elyria district manager succeeds Ludwig as Toledo district manager. Ludwig retains his vice presidency and will work on administrative assignments from the company general offices in Columbus. **Donald E. Barr,** Springfield division manager, succeeds Taylor as Elyria district manager. **David E. Young,** assistant Toledo district manager succeeds Barr in Springfield.

● **Charles Alden** and **G. King Kells** have been promoted to branch manager positions at Neptune Meter Company with dual responsibilities for Superior Meter Company activities. Alden is responsible for northwestern and western region of the U. S. Kells, who has been appointed manager of the firm's San Francisco-Bay area branch, will headquarter in Millbrae, California.

● **James L. Higday** has been appointed superintendent of gas operations for The Kansas Power and Light Company. He was formerly superintendent of gas distribution.

L. C. Peschel

● **L. C. Peschel,** controller of Mountain Fuel Supply Company of Salt Lake City, has been elected a director of the firm replacing **L. Clyde Olpin** who resigned recently. He has been affiliated with Mountain Fuel and its parent organization since 1920.

● **Walter E. McWilliams,** former industrial sales manager, has been appointed assistant general sales manager of The Peoples Natural Gas Company of Pittsburgh. **William R. Gartz** succeeds him as industrial sales manager.

● **Warren A. Knight** has been named director of publicity of Public Service Electricity and Gas Company, succeeding the late Joseph A. Gallagher. Knight has been assistant director of publicity since 1957.

● Philadelphia Gas Works' three operating departments — customer service, distribution and production — have been combined under the general direction of **Edward F. Hubbard,** who has been appointed to the newly-created post of director of operations. Hubbard is succeeded by **Hammitt L. Robbins** as the new director of administration. **Robert R. Lockhart,** former assistant director of finance and accounts, succeeds Robbins as director of services. **Frederic D. Justin** succeeds Lockhart as assistant director of finance and accounts, moves from the position of manager, management services department which has been dissolved. **Daniel B. Allison** has been appointed assistant to the director of finance and accounts, and the commercial department formerly under Allison's direction has been separated into three activities each of which has been accorded departmental status and placed under the responsibility of newly-appointed department managers. **Elmer F. Sahlender,** manager, customer accounting department; **Frank T. Hager** manager, collection and meter reading department; and **Robert W. Lobb,** former assistant manager, general accounting department, is the manager of the newly-created customer relations department. **Harry J. Schmidt,** technical assistant to the director of finance and accounts, succeeds Lobb as assistant manager, general accounting department.

● Roots-Connersville Blower, Division of Dresser Industries, Inc. has established a new district sales office at Houston, Texas. **Daniel Fulton** has been appointed manager of the territory which includes Texas, Louisiana, and Southern Arkansas.

E. L. Phillips

Ellis L. Phillips, 85, philanthropist and former president and chairman of the board of Long Island Lighting Company, died January 29 at his home in New York City. He served as LILCO's first general manager and became president in 1911; he served as chairman of the board from 1937 until 1945.

reduce corrosion

...use MUELLER®

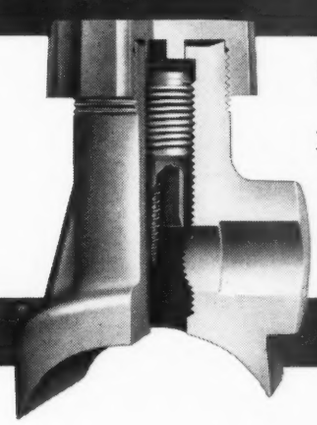
Tees and Curb Stops with insulating couplings

Mueller Tees and Curb Stops with insulating couplings effectively insulate the service line at the main and at the curb. This permits the use of dissimilar metals, such as copper service pipe, with a steel main. Electrical bond is broken at convenient points and corrosion is reduced.

Check corrosion in existing systems by replacing present curb stops with Mueller Cutting-In Curb Stops which have insulating couplings.

Mueller Tees and Curb Stops with compression couplings for steel pipe can be converted to insulating couplings for copper pipe by using a Mueller Insulating Adapter Gasket.

This detail of design greatly simplifies the ordering and inventory of tees and stops. It is typical, however, of the attention to detail in research, design and engineering that becomes a part of every Mueller product produced for the gas industry.



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. . . permit fast, safe service connections to plastic pipe. Tee is solvent-welded to main and service line. Main is then drilled under pressure by rotating built-in cutter. Cutter retains coupon and backseats against "O" ring in top of tee to prevent leakage. The tee includes a valve for future shut-off.

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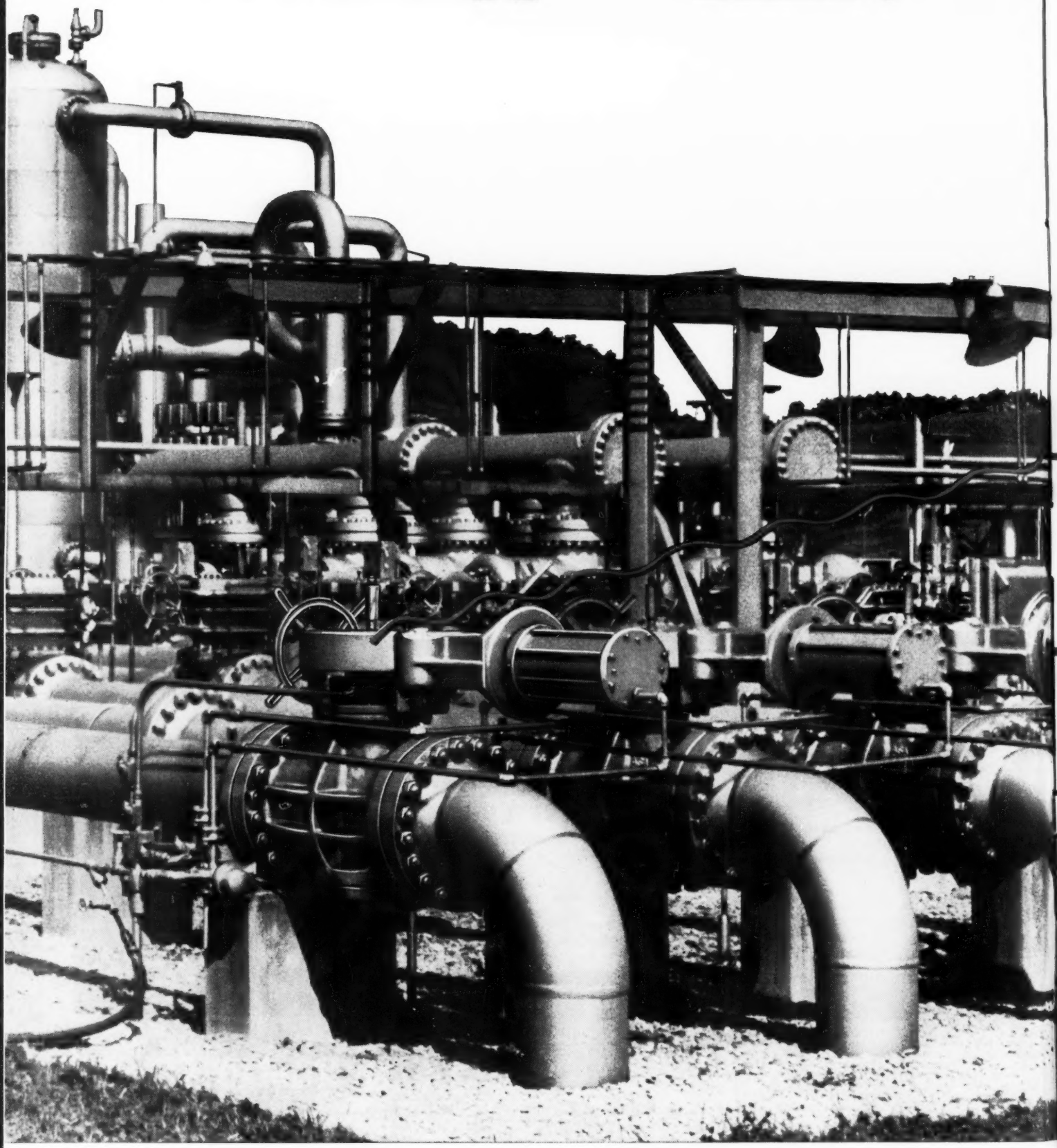
In Canada: Mueller, Limited, Sarnia, Ontario

It's what happens after you



ROCKWELL-

push the button that counts!

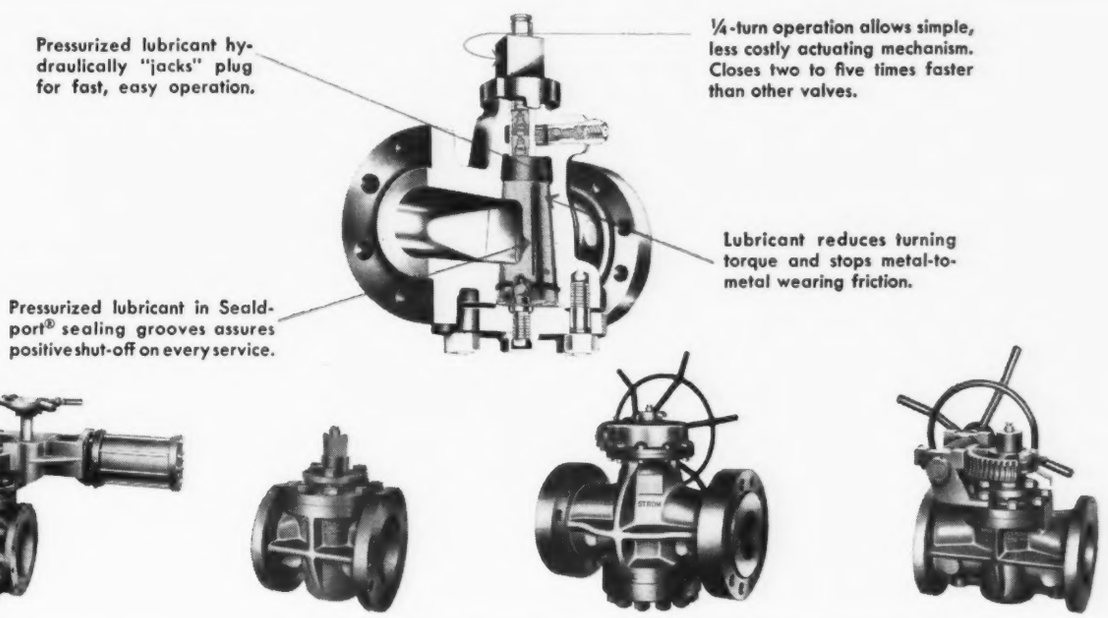
The new compressor station shown at the left is completely equipped for push button operation. But this kind of remote operation is only as reliable as the valves it activates. One stuck valve means inefficiency at least . . . catastrophe at most. That's why you always see Rockwell-Nordstrom lubricated plug valves where gas transmission and distribution men must have perfectly *dependable* control.

Rockwell-Nordstrom valves have proved ideal for automatic or remote operation because lubrication insures basic operating advantages that you can't expect in ordinary valves. See the drawing below for just a few of the reasons why these valves have been used in more gas industry installations than any other valve.

Rockwell-Nordstrom is the original and world's most complete line of lubricated plug valves. Available with electric motor, pneumatic and hydraulic actuations to meet any need. They cost no more to buy, often less, than ordinary valves and they save maintenance and down-time dollars everywhere they're used. For further details, write: Rockwell Manufacturing Company, Pittsburgh 8, Pa., Canadian Valve Licensee: Peacock Brothers Limited.

ROCKWELL-Nordstrom VALVES
another fine product by
ROCKWELL

LUBRICATION MAKES THE DIFFERENCE


Pressurized lubricant hydraulically "jacks" plug for fast, easy operation.
¼-turn operation allows simple, less costly actuating mechanism. Closes two to five times faster than other valves.
Lubricant reduces turning torque and stops metal-to-metal wearing friction.
Pressurized lubricant in Sealdport® sealing grooves assures positive shut-off on every service.

Nordstrom VALVES

Personals

● Several recent personnel changes at Saskatchewan Power Corporation include additions to the management advisory committee, so it now consists of an assistant general manager in charge of engineering and (chief engineer), **W. B. Clipsham;** assistant general manager in charge of operations, **R. R. Keith;** director of public and employee relations, **C. E. Smith;** and comptroller in charge of financial operations, **D. E. Cuddington.** Smith, formerly public relations director, has now been appointed to coordinate the three divisions — public relations, personnel, and industrial relations.

● **Charles M. Dever Jr.** has been appointed assistant manager of Tube Turns' midwest district in Chicago. Dever was formerly manager of sales service.

● **Samuel Joseph** and **Benjamin Schiffer** have been appointed vice presidents of H. Zinder & Associates, Inc., consultants to the natural gas distribution companies.

● **Allistair Dunn** has been named director of manufacturing for Ohio Injector Company, under a newly aligned production organization grouping. Dunn was formerly with Blackhawk Manufacturing Company. **Verland W. Belt,** plant superintendent in Ohio, has been named manager of The Ohio Products Company, a subsidiary. **John T. Lesko** and **Malcolm K. Sheppard, Jr.,** have been named to newly created posts of manager, manufacturing-engineering, and manager, industrial engineering, respectively.

● **Emil Copeland** has been appointed sales representative and service engineer for Lancaster Meter Parts Company in the Midwest, after completion of a training course at the factory.

● **William M. Little,** executive vice president of Cascade Natural Gas Company, has joined the R. A. Ransom Company, Inc., consulting engineers of Washington, D. C. as project manager on construction of the North Carolina Natural Gas Corporation system in eastern North Carolina. After completion of construction of the North Carolina system, Little will join that organization as manager of operations.

W. M. Little

● **Ernestine Adams,** management and economics editor of AMERICAN GAS JOURNAL, Dallas, has been elected vice president of the Technical Writing Improvement Society, national organization of educators, editors, and engineers interested in improvement of scientific communications.

● Brooklyn Union Gas Company has announced promotion of **Eugene H. Luntey** to assistant engineer of development and planning, **Edmund K. Mehring** to superintendent of holder distribution, and **Alfred R. Bayer** to chief chemical engineer, laboratory.

● **Matthew J. Beecher** has joined Commonwealth Services, Inc. and will work with problems involving industrial relations. He was formerly manufacturing division manager for American Management Association.

● Controls Company of America has announced four major promotions: **Phil Bain,** former manager, advertising and market research, appliance and automotive controls, has been promoted to product line manager, industrial and commercial controls sales. **H. R. Chapin** has been named chief product engineer, appliance and automotive controls. He was formerly engineering supervisor of the switch group. **J. J. Kaleba,** formerly a product engineer, has been appointed engineering supervisor of the switch group. **Marshall Zugehar** has been promoted to sales coordinator, international division activities.

● Consolidated Natural Gas Company's rate department in Washington, D. C., has been reorganized and **George N. Reed** named manager of the department. He was formerly system rate engineer. **Norman A. Flaningam,** formerly an attorney employed on a part-time basis, has been named chief Washington counsel for Consolidated.

● Cathodic Protection Service has appointed **Dave Jones** and **Charles W. Scamman** as new sales representatives.

● Corrosion Rectifying Company of Houston, Texas, has appointed **Robert L. Adair** manager of sales of the supply division for the Southern states.

● **W. J. Bestmann** has assumed management of Continental Equipment division of Fisher Governor Company succeeding **A. M. Capper,** founder and president of Continental until his recent retirement. Bestmann has been general manager of the Woodstock, Ontario, plant of Fisher for the past three years.

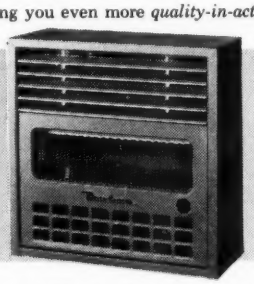
Dearborn Quality in Action...

is your best package of PROFIT

The NEW Dearborn Sealed-Vent WALL HEATER

This amazing new Dearborn Sealed Vent thru-the-wall gas area heater introduces a new dimension in beauty and safety! Extremely simple installation. Expertly and tastefully designed by the makers of the outstanding Dearborn Regency, it will please the eye—provide safety and comfort for any customer. It is an outstanding example of Dearborn design and engineering bringing you even more *quality-in-action.*

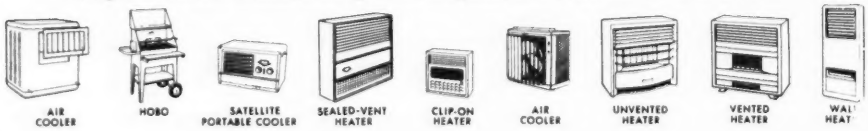
NEW from Dearborn, the Clip-on unvented wall heater is a leader almost overnight! Rated at 10,000 BTU, the "Clip-on" is just right for bathroom, bedroom, utility room, kitchen, small office, or any other small space. Available in white or famous Dearborn coppertone. Features cool safety cabinet, Hi-Crown cast iron burners, forward heat flow, stainless steel radiant, pilot light and delightful beauty of appearance. Destined for tremendous volume.

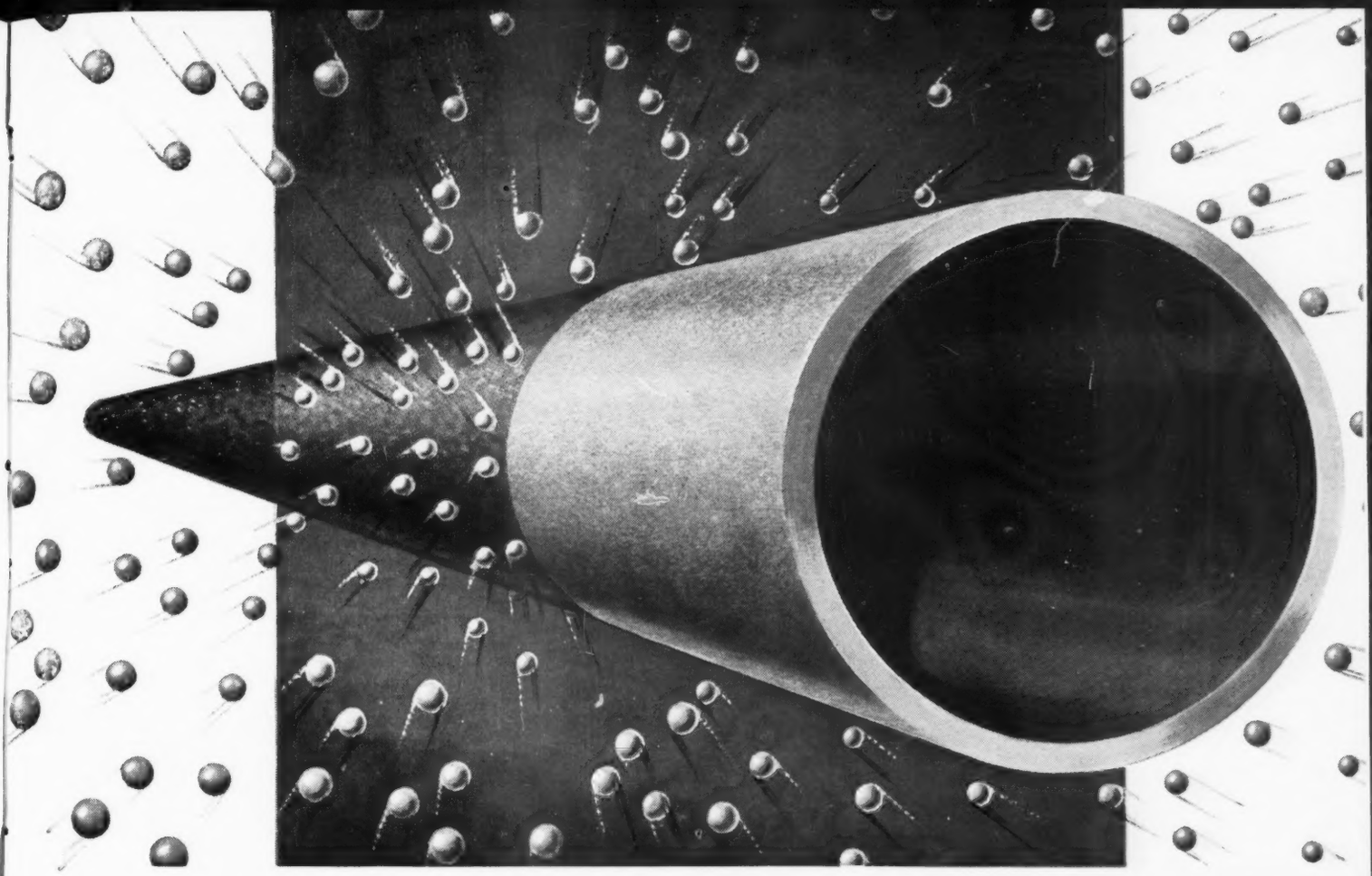


From the superb new Sealed-Vent, the beautiful Regency, and the smart new Crest series to the smallest new star, the "Clip-on" wall heater, Dearborn is the standard of quality among gas area heaters. With improvements and new products being introduced as part of Dearborn's *Quality-In-Action* 1959 program, every Dearborn dealer is assured of greater profit. More than ever, in 1959, you'll be glad you're selling Dearborn!

Dearborn® STOVE COMPANY, DALLAS, TEXAS

Regional offices: Dallas, Chicago, Los Angeles, San Francisco, and Atlanta





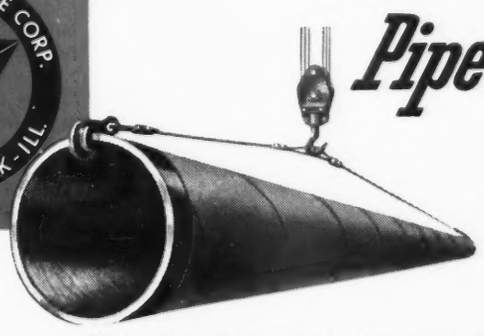
Steel Shot Cleaning makes Pipe Protection Stay Put

Applying protective coatings to improperly prepared pipe surface makes about as much sense as building a skyscraper on sand. Pipe Line Service has always pioneered in developing new ways to insure a good bond . . . a bond that makes protective coatings practically inseparable from the pipe itself.

An outstanding example is steel shot cleaning. Special machines permit bombardment of the pipe surface with millions of steel pellets traveling at high speed. Result? Not simply removal of mill scale and rust . . . but actually an "etching" of the steel surface. This slightly roughened surface allows the protective coating to "take root"—gives you the years of protection that you should have.

We emphasize Pipe Line's steel shot cleaning process because it was one of the great steps forward in maximum protection of *your* pipe investment. It's a manufacturing extra that's provided at no extra cost . . . and one more reason for extra confidence in specifying protection by PLS!

PIPE LINE SERVICE CORP. SERVICE EQUIPMENT MATERIALS FRANKLIN PARK - ILL.



Pipe Line Service Corporation

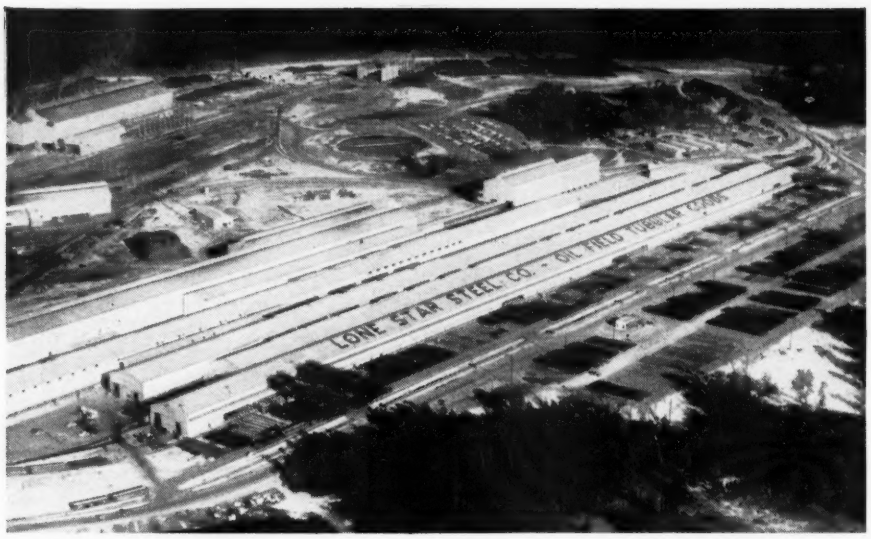
General Offices and Plant: Franklin Park, Ill.

Quality pioneers in coating and wrapping pipe for over a quarter century

A Subsidiary of American Steel Foundries

Plants also at: Monmouth Junction, N. J.; Glenwillard, Pa.; Sparrows Point, Md.; Longview, Tex.; Corpus Christi, Tex.; Provo, Utah; Harvey, La.

Sales offices at all plant locations . . . and Atlanta, Ga.; Dallas, Tex.; Houston, Tex.; Lincoln, Nebr.



Specify line pipe from Lone Star,
the industry's ultra-modern
pipe mill

Generally called America's most modern steel plant . . Lone Star is primarily dedicated to supplying Joe Roughneck's API casing, tubing and line pipe needs.

Completely integrated . . Lone Star Steel's huge plant is located right in the middle of Joe Roughneck's busy mid-continent oil and gas area . . so overnight pipe delivery is routine. Tough steel and rigid and repeated tests are your assurance of API quality in every length. All Lone Star pipe is fully normalized, of course.

Neighbor, wherever you are, specify Lone Star and we both get a good deal.

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Houston, Texas | Midland, Texas | Tulsa, Oklahoma

Personals

● **D. Rex Scott** has been named assistant general manager of Robertshaw-Fulton Controls Company's Western Research Center. He was previously district sales manager of the firm's Cleveland office.

D. R. Scott

D. M. McDowell

● **D. M. McDowell** has been appointed director of engineering of Roots-Connersville Blower Division of Dresser Industries, Inc. He will be responsible for direction and management of all phases of Roots-Connersville's engineering program. He was formerly with the LeRoi Division Westinghouse Air Brake Company.

● **Harry C. Walton,** industrial and sales engineer for Commonwealth Natural Gas Corporation of Richmond, Virginia, retires March 1, because of ill health.

● **Richard H. Cook** has been promoted to engineer in charge of operations in the gas production department of Rochester Gas and Electric Company.

● **Donald S. Bittinger** has been elected president of Washington Gas Light Company; **Everett J. Boothby** will continue as chairman of the board and chief executive officer. Board of directors also has appointed **Otis H. Ritenour** senior vice president; elected **C. Oscar Berry** and **Richard H. Bussard** vice presidents, and accepted the resignation of **Christopher H. Pope,** a director.

● **Jack Searls** has joined Controls Company of America as manager of field sales, heating and air conditioning controls. He will manage the gas product line, concentrating immediately on building gas controls sales.

● **Ernest B. Hanmer** has been named sales director for Magic Chef division of Dixie Products, Inc. He was formerly southeastern regional sales manager.

● **W. G. Gruneisen,** sales engineer with B. R. Jones & Company, has been named sales representative for Fisher Governor Company in southern California.

● **Arthur J. Joseph** has been named zone sales manager for Motorola Communications & Electronics Inc., in the Abilene-San Angelo-Midland area succeeding **Robert Blakestad** who has been named southern account executive for the company's government sales department.

● Consolidated Natural Gas Company has elected **Malcolm S. Lonon,** treasurer, and **John Miller,** secretary. Lonon succeeds **H. C. Johnson** who will continue in the office of vice president and chief financial officer of the company. Miller succeeds **R. E. Palmer** who has retired under the company retirement policy. **Walter C. Kronke** has been appointed assistant treasurer, and **John C. Stansbury** assistant secretary.

COMING EVENTS IN THE GAS DISTRIBUTION INDUSTRY

March

2- 3 A.G.A. general management conference, Hotel Statler, Cleveland, Ohio.
4- 5 Gas Conditioning Conference, University of Oklahoma, Norman, Oklahoma.
4- 5 Gas Processing Conference, University of Oklahoma, Norman, Oklahoma.
5- 6 SGA distribution management round table conference, Jung Hotel, New Orleans, Louisiana.
6 SGA accident prevention round table conference, Jung Hotel, New Orleans, Louisiana.
8-11 ASME Gas Turbine Power conference and exhibit, Netherlands-Hilton Hotel, Cincinnati, Ohio.
9-11 Mid-West Gas Association, annual meeting and convention, Hotel Ft. Des Moines, Des Moines, Iowa.
16-20 NACE, Sherman Hotel, Chicago, Illinois.
19-20 NEGA, annual meeting, Hotel Statler, Boston, Massachusetts.
24-26 PCGA sales conference, Sacramento, California.
26-27 Oklahoma Utilities Association, annual convention, Mayo Hotel, Tulsa, Oklahoma.
26-27 Eighth Annual Instrument Short Course, sponsored by Southern California Meter Association, Los Angeles Harbour Junior College, Wilmington, California.
31-April 2 Corrosion Conference, University of Oklahoma, Norman, Oklahoma.
31-Apr. 2 American Power Conference, sponsored by Illinois Institute of Technology, Hotel Sherman, Chicago, Illinois.

April

1- 3 GAMA, annual meeting, Americana Hotel, Bal Harbour, Florida.
6- 7 Instrument Society of America, 2nd national symposium on chemical, oil, and gas instrumentation, St. Louis, Missouri.
6- 9 A.G.A. distribution conference, Netherland-Hilton Hotel, Cincinnati, Ohio.
7- 9 A.G.A. industrial and commercial sales conference, Hotel Warwick, Philadelphia, Pennsylvania.
10- Maryland Utilities Association, annual convention, Baltimore, Maryland.
14-16 Southwestern Gas Measurement Short Course, University of Oklahoma, Norman, Oklahoma.
16- Pennsylvania Gas Association production conference, Drexelbrook Swimming and Tennis Club, Drexelbrook, Pennsylvania.
19-23 ASME Oil and Gas Power Division conference and exhibit, Shamrock-Hilton Hotel, Houston, Texas.
20-22 A.G.A.-EEI accounting conference, Sherman Hotel, Chicago, Illinois.
23-24 Indiana Gas Association, annual convention, French Lick-Sheraton Hotel, French Lick, Indiana.
27-29 SGA annual convention, New Orleans, Louisiana.

for Distribution Digging there's nothing like it *

TIGHT QUARTERS. Narrow tree lawns, trees, utility poles, intersecting service lines—in conditions like these nothing digs trench like a Cleveland "Baby Digger."

PRECISION TRENCHING. Note how precisely this Cleveland 92 is placing spoil on the sidewalk—off the well-kept lawn. Trench walls are smooth and straight. Backfilling will be fast, easy and clean. The "Baby Digger's" fine balance on smooth, friction-free crawlers contributes to its precision-maneuverability.

ONLY 4′ 6″ WIDE. The narrow Cleveland 92 digs easily past obstructions, maintains steady, high trench production. More than 30 usable wheel and crawler speed combinations give it the right combination of power and speed for digging all soils—in mud, frost, shale or rocky ground.

***the Cleveland "Baby Digger," of course**

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EDITOR'S NOTE: Unquestionably, the domestic oil and gas producing industry today is suffering many economic troubles. Large among its problems is the question of natural gas regulation and price fixing. The producer finds himself in an unusual position. One of his products — natural gas — is regulated and the price fixed by governmental action. In marketing the other product — crude oil — he must fend for himself in the open market. The producer has no choice in this forced "separation" even though both of his products come from the same hole in the earth. The sagacity of forced separation of oil and gas . . . and attempting to legislatively overrule the law of supply and demand is questionable. It seems doubtful that Nature intended it to be so . . . for Nature in her wisdom didn't separate the two in the bowels of the earth. And mankind has never successfully overruled the natural law of supply and demand.

Whether or not you agree with the authors of the discussion on these pages, we believe you will agree that they should be heard. For that reason, the editors have brought it to your attention.

Economists Review Gas Producers' Dilemma:

Production Up, Costs Up, Unit Revenues Down, Prices Artificially Depressed

Many of the troubles of the United States oil and gas producers' today are caused not so much by the fact that they are selling two competing forms of energy, but that they are forced to sell one — natural gas — below its true market value because of artificially depressed prices.

That's the conclusion drawn by Gulf Oil economists W. B. Davis and J. L. Schweizer in a paper presented recently at the 1959 Annual Meeting of the American Institute of Mining, Metallurgical, and Petroleum Engineers in San Francisco.

In their paper, *"Natural Gas — Partner and Competitor,"* the authors pointed out that — in spite of sharp increases in the real costs of finding and developing oil and gas in the United States — the producer is getting no more revenue per unit of product than he was in the depression days of the early 1930's.

This is especially true in regard to natural gas because of the Phillips Decision in 1954 — which gives the Federal Power Commission control of wellhead prices of natural gas — has resulted in halting the trend of gas prices to seek their natural economic level in a competitive market.

Since 1954, gas prices have barely managed to keep up with inflation.

Authors Davis and Schweizer point out that their purpose in writing the paper was to emphasize the fact that natural gas is much more than just a source of **additional revenue** to the crude oil producer.

While a small fraction of crude oil is used to make lubricants and for chemical feed stocks, most of it is used as a source of energy. Natural gas, along with coal and other energy fuels, also serves the U. S. energy market. Consequently, natural gas is a competitor to crude oil at the consumer level, and the supply and price of natural gas have a significant effect on crude oil demand.

"There is some question as to whether natural gas now is more important to oil producers as a source of revenue or as a competitor," the authors point out; It is reasonably certain, however, that if artificial control of gas prices continues, the importance of gas as a competitor will grow much faster than its importance as a revenue source."

Tracing the early history of the producing industry, the authors emphasize that the early sales value of natural gas produced with crude oil was of secondary importance. Only small amounts were sold for fuel, and this was limited to the general vicinity of the production. Revenue from these sales in the few instances where sales were made, was regarded as a fortunate windfall by the producer.

Natural gas has grown steadily as a source of revenue for the producer. In 1922, the value of gas at the wellhead, including royalty payments, totaled about $85 million in the U. S. This was less than 9 percent of the total value of the petroleum production that year.

Gas revenue has grown faster than oil revenue; by 1958, the wellhead value of natural gas in the U. S. amounted to about $1300 million, or about 15 percent of the total value of produced petroleum. The 1958 value of natural gas was equal to or greater than the value of crude oil produced domestically in all but three years prior to 1939.

For the period, 1920 to 1958, natural gas's share of the consumer market increased from 4 percent to 27 percent. During this same period, oil's share increased from 13 percent to 42 percent; water power has remained constant at 4 percent and coal's share of the market decreased from 78 percent to 24 percent.

Coal's large loss in share of the market does not represent a very large loss in volume. Rather, it is due to failure to grow. This means that crude oil and natural gas have taken nearly all the growth in energy consumption since 1920.

The authors predict that the change in distribution of energy consumption among fuels from 1958 to 1970 will be about as follows:

Crude oil — 42 to 44.5 percent;

Natural gas — 27 to 30.5 percent;

Coal — 24.1 to 18.2 percent; and

Water power — 3.8 to 3.7 percent.

In 1932, 28 percent of the energy requirements of the U. S. was supplied by oil and 10 percent by gas.

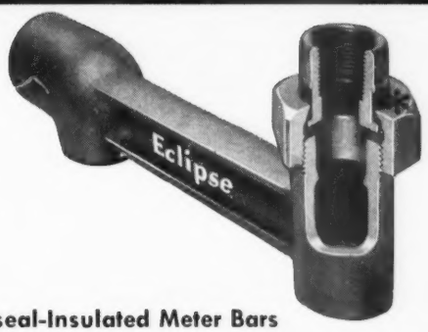
By 1958, just 26 years later, gas has trebled its share of the market and was supplying as much of the market in 1958 as oil was supplying in 1932; practically all of the increase in the gas share has occurred during the last half of the 26-year period.

Davis and Schweizer feel that natural gas has long since ceased to be a by-product of oil production, and should now be considered a full-fledged partner in the energy business.

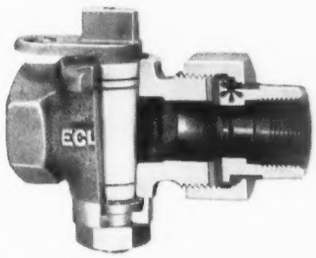
"The freezing of gas prices by the Phillips Decision has upset the law of supply and demand, and gas prices can no longer continue to rise toward their natural competitive level, in the face of increasing demand," they state.

They conclude, "The best remedy for this situation lies in the freeing of natural gas prices from control and allowing them to compete in the open market." ★ ★ ★

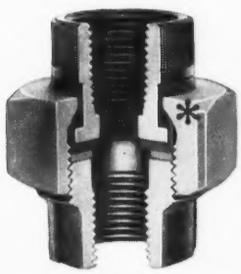
4-Ways Better Insulation against house currents



Wedgeseal-Insulated Meter Bars
— for tin (5-Lt through 30-Lt), aluminum and iron case meters in variety of connection sizes, with or without integral gas cock.



Wedgeseal-Insulated Gas Cock
— offered in lock wing and flat head styles, standard and "Retained Key" (tamperproof) construction. In ¾", 1", and 1¼" sizes. Individually tested with 125-lb air under liquid.



Wedgeseal-Insulated Union
— available in ⅜", ¾", 1", and 1¼" sizes. Recommended for working pressures up to 150 psig.

ECLIPSE *Wedgeseal* INSULATOR

1 **CAN'T BE LEFT OUT**—it is integral with the tailpiece.

2 **WON'T SHEAR OFF**—has exclusive wedge design that withstands 350 ft-lb torque without damage.

3 **WON'T DETERIORATE**—nylon (Zytel 105) is not affected by natural, manufactured, or LP gas; is form stable at 400° F, and suitable for continuous operation at 275° F.

4 **SIMPLIFIES INSTALLATION**—assembly of insulation is eliminated, and Wedgeseal-insulated gas cocks and meter bars reduce number of threaded fittings and make-up time.

Add it up—4-way protection against metal-to-metal contact, against shorting or jumping. Wedgeseal is the strongest, simplest, most economical insulator you can use. Prove it out at no cost—send for a free Wedgeseal-insulated unit today. Use the convenient coupon.

Eclipse®

UNIONS • GAS COCKS
METER BARS

GAS SERVICE PRODUCTS DIVISION
Eclipse Fuel Engineering Co.
1108 Buchanan St., Rockford, Illinois

Please send me free of charge the following Wedgeseal-insulated unit:

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GAS COCK Size.....Retained Key.....Lock Wing.....
Standard.....Flat Head.....

METER BAR No..... ..... x ..... for ☐ tin, ☐ aluminum or iron case.

NAME.....

COMPANY.....

STREET.....

CITY.....STATE.....

WHEN YOU NEED COATED AND WRAPPED PIPE . . . SPECIFY

the Southeast's leader in pipe protection

COATING
WRAPPING
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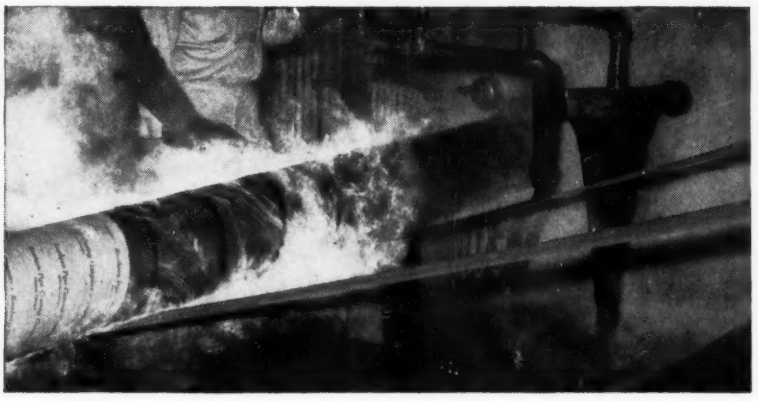
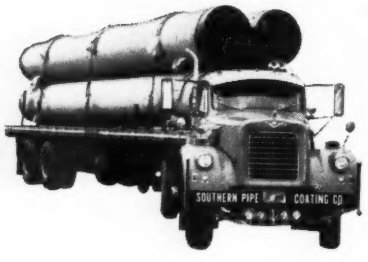


There are many reasons behind Southern Pipe Coating Company's leadership in the pipe protection field . . . to offer you many advantages.

You realize savings—in time and money—thru faster handling of your order from the South's most modern, fully automatic plant. Our experienced personnel know how to deliver pipe coated and wrapped to exact specifications—standard, or to your own custom requirements.



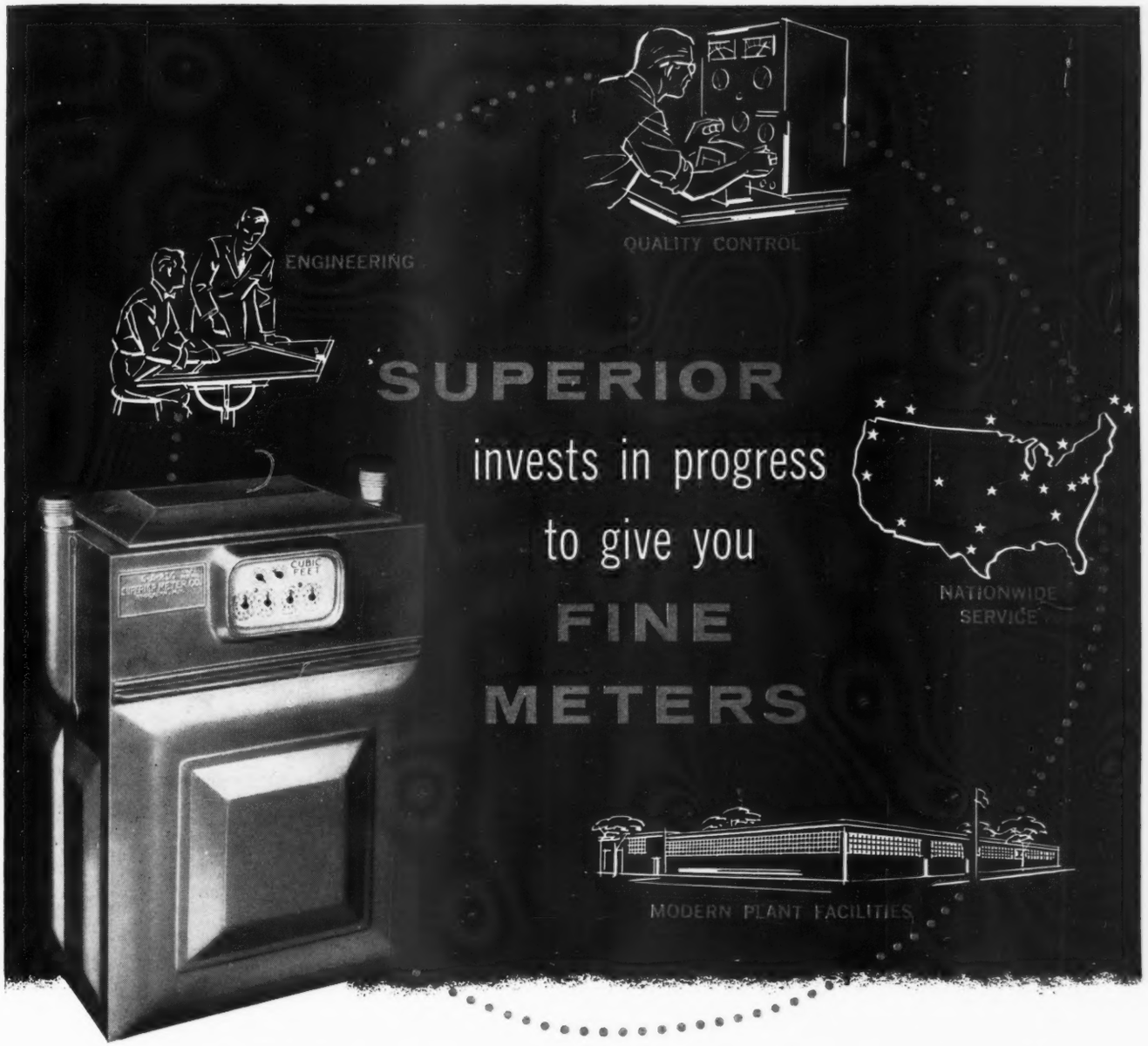
Take advantage of immediate shipments from a truck fleet that delivers anywhere in the South—right to the job site. Or, you can store your pipe—at no cost—in our ample 17-acre plant. As an extra advantage to you, recently expanded facilities now permit us to handle coal tar or cement lined pipe up to 84" O.D.

For perfectly processed coated pipe—for quality, dependability and service, when you buy . . . specify

Southern Pipe Coating Company

795 PEACHTREE STREET, N. E. *ATLANTA, GA.*

Write or call for illustrated catalog and specifications, or for a quotation.



A larger staff of respected meter engineers...quality control specialists...nationwide sales and service... modern, high-precision machine tools... a brand new plant turning out the advanced-design Superior aluminum case meter, also the well-known tin case meters...that's the Superior Meter Company of today, now part of Neptune Meter Company, one of the world's major meter and instrument groups.

For Superior customers this means meters of sustained, fine-instrument accuracy, the result of one of the finest combinations of men, methods and machines. It also means a representative in your area who understands your needs and gives you service when you want it.

You now get more, at no extra cost, when you specify "Superior", the meter of enduring accuracy.

For Quality Meter Repairing and Repair Parts...
Superior maintains meter repair shops with rigid standards of quality control as an addition to your own facilities. Write or phone today.

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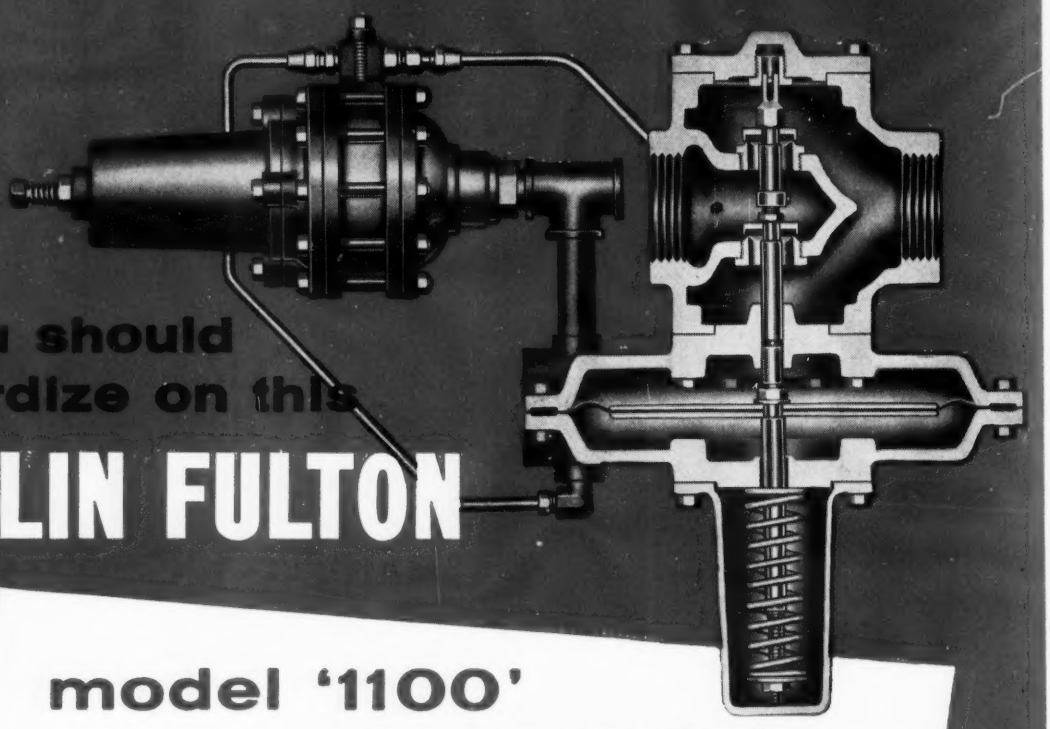


you should standardize on this

CHAPLIN FULTON

model '1100' gas regulator

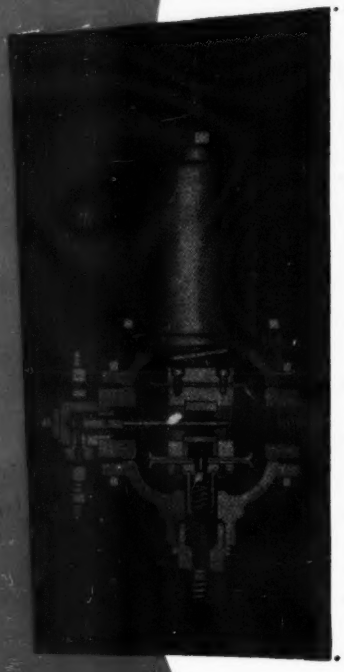
Let's not beat around the well head, this Model "1100" is the most versatile gas regulator in the business. It gives a wider range of flow control in industrial, commercial or distribution installations. Just look at these points of superiority:

wider application
Inlet Max.—400 psi. Outlet Range 1" to 150 psi. Size—2" only, screwed, flanged 125 or 250 ASA

greater capacity
24,000 cfh at 10 psi to ounces; 114,000 at 100 psi. Body contoured for flow

easier maintenance
Regulator or pilot can each be serviced without disturbing the other. Easily accessible orifices in both, quickly renewable

simpler installation
Only one connection required. No complicated pins or toggles to adjust



the heart of model 1100

TYPE 51 VARIABLE PRESSURE PILOT

- Unitized construction—valve lever and orifice as a unit are removed from the outside, without disturbing balance of assembly. The likely trouble spot, the orifice, is outside where you can get at it quickly. No internal tubes to clog.
- Twin diaphragms remove as a unit
- Internal relief unit—guards against overpressure
- Spring unit—remove three screws to change springs
- Built for service
- Used for accuracy

Write for bulletin 1100

ACCURATE CP MFG CO DEPENDABLE

WSW-6836

Chaplin-Fulton

MANUFACTURING COMPANY

Pittsburgh 25, Pennsylvania

how pipe line engineers can sleep better

Dearborn's NO-OX-ID coatings and wrappers aren't exactly sleeping pills but the engineers who specify them for transmission or distribution systems don't have restless nights worrying about corrosion break-throughs.

NO-OX-ID provides both chemical and mechanical protection against moisture penetration and soil action. It is protection that lasts for decades – under ground and even under water. In tests, NO-OX-IDs have completely protected highly susceptible metals submerged in ocean locations year after year.

There's a NO-OX-ID coating or wrapper especially suited to your particular job and available for over-the-ditch or other type applications. Ask a Dearborn engineer.

DEARBORN CHEMICAL COMPANY

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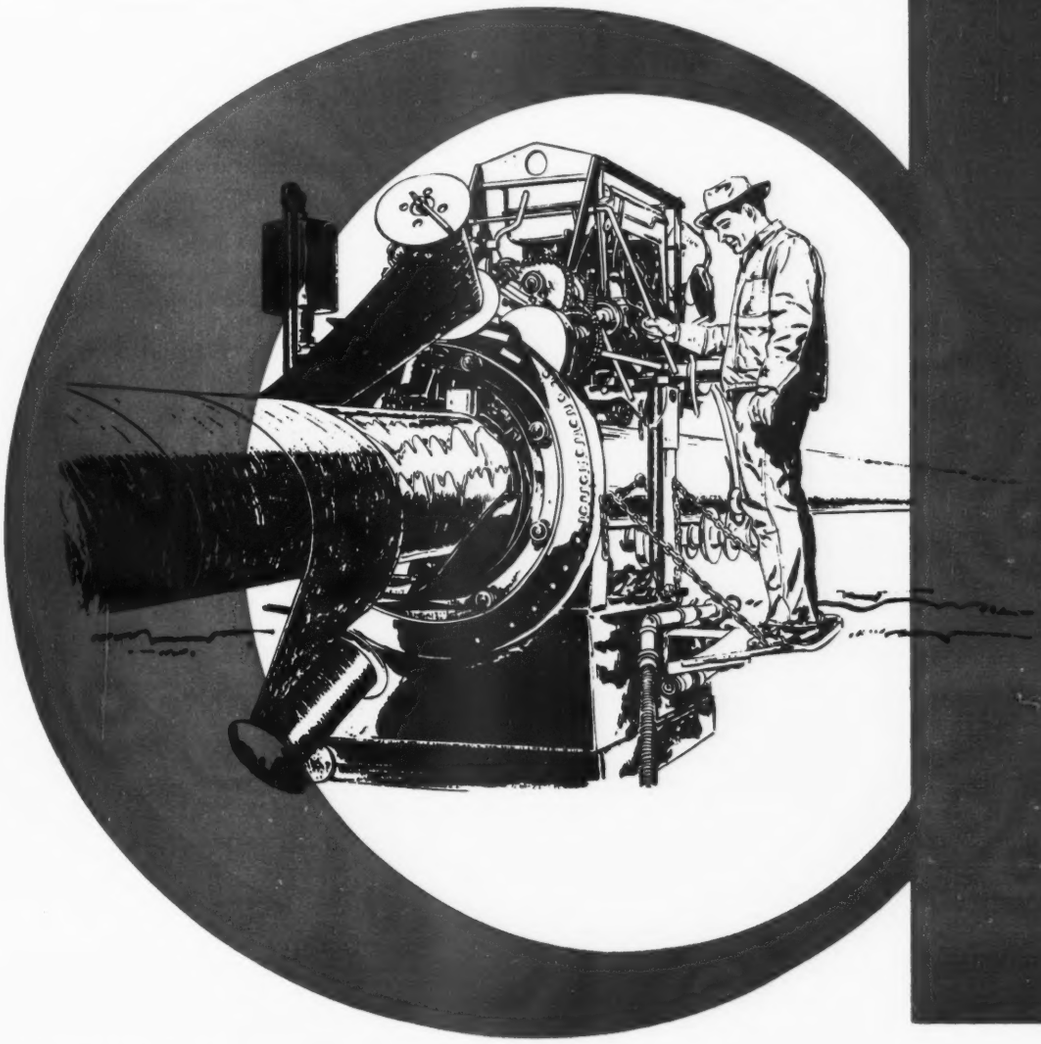
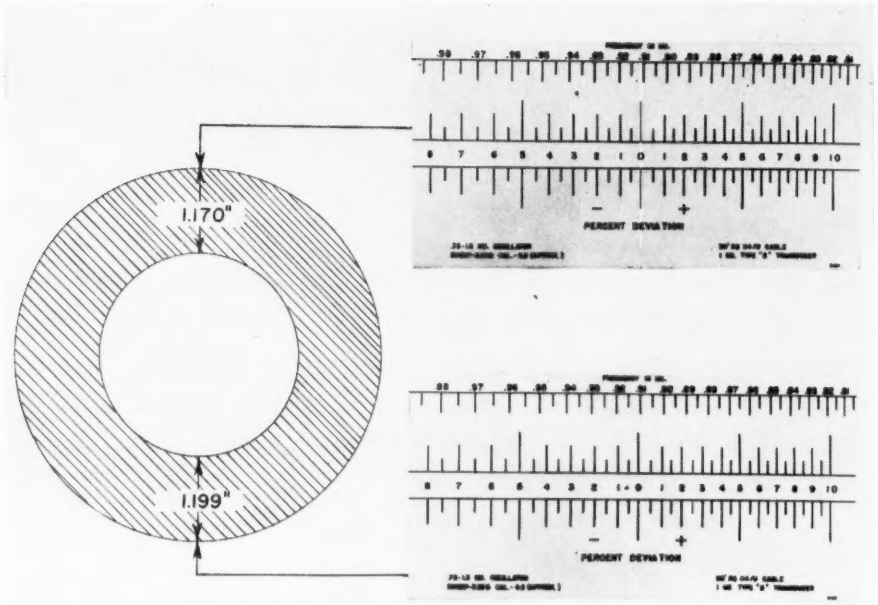


pioneer in the science of corrosion control

dearborn



DETERMINATION OF ECCENTRICITY OF HEAVY WALLED TUBES

Even slightest variation in wall thickness about pipe's circumference is determined by ultrasonic resonance qage. Readings can be taken at several check points or probe can be moved spirally around pipe for continuous readinq. Special scales, calibrated in percent eccentricity, eliminate calculation.

External Detection of Internal Corrosion Made Possible By Ultrasonics

Peter K. Bloch, *President*
Branson Instruments, Inc.
Stamford, Connecticut

IN LARGE-SCALE CORROSION SURVEYS of gas piping or LPG storage tanks, drilling holes is an impractical method of corrosion detection. It would be impossible to drill enough holes to get an adequate picture, and welding them up would be time-consuming and expensive.

The ultrasonic resonance gage eliminates such drilling for corrosion tests. To use the gage, a probe is placed over the surface being tested, and metal thickness is obtained within micrometer accuracy. This makes it possible to check vast areas of gas piping for corrosion quickly and economically.

Before ultrasonic equipment is used to check an extensive area, a few preliminaries are needed to insure fast, accurate testing.

1. The site to be covered is mapped, and check points are carefully chosen.

2. If, for some reason, eccentricity must be determined, four points 90 degrees apart are selected about a circumference.

3. Badly pitted exterior test points are sanded, and a thin film of water, oil, or glycerin is applied between the instrument's probe and metal surface for maximum contact.

Each type of installation has its own survey techniques. Gas mains, for example, are tested at bell holes or other normally exposed locations. In one instance, pipes at a river crossing had been exposed for a number of years, leaving the surfaces badly pitted. After sanding, pipe wall thicknesses were quickly determined and badly corroded sections were quickly replaced.

Equally important, corrosion *rate* was determined. The difference between original and latest measured pipe dimensions, divided by pipe age, gave average corrosion rate. This figure permitted replacement schedules to be prepared more realistically.

Ultrasonic testing is fast. A recent corrosion check of 30,000-gal propane tank, with readings taken at 300 points, took only six hours.

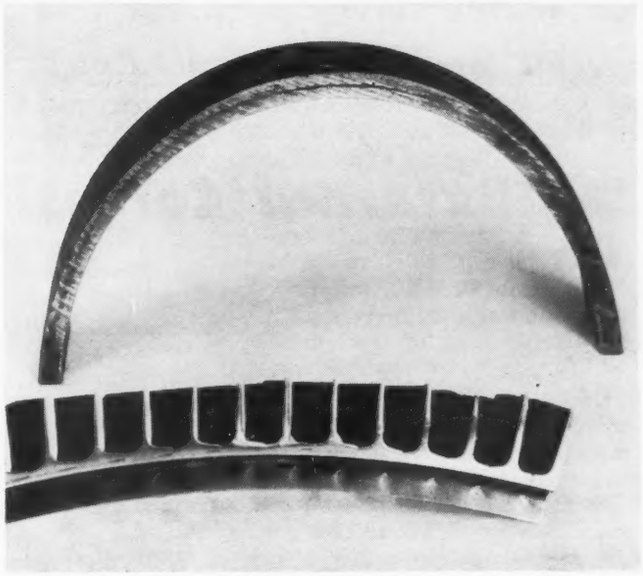
Results showed no severe corrosion or deep pitting at any test locations, nor any large thickness variations. The survey also disclosed that there was no heavy internal scale, corrosion was uniform, and average loss of metal thickness throughout was about 0.020-in.

Types of Instruments

Two basic types of ultrasonic resonance gages are used to test gas production, storage, and distribution equipment. One is a portable, battery-operated instrument. Weighing only 18 lb, it allows one man to cover a large area.

The instrument works on a resonance principle — the resonant or natural frequency of most metals and plastics varies inversely with thickness. The operator, wearing earphones, holds a transducer against the work. He slowly varies the probe's frequency until he hears a distinct change in pitch

With larger unit, special scales with limited thickness ranges can be used, allow tolerance to be whittled to ± 0.0005-in. Device measures only the actual metal thickness — not scale or rust.



Instrument also detects other faults of pipe or welds, as shown at top by laminar crack in pipe section detected by ultrasonic resonance gage. Fault weld in compressor shroud — bottom of photo — was found by gage.

and notes a sudden increase in the instrument's milliammeter reading. At this point, the transducer's frequency matches the natural frequency (or harmonic) of the part under test, and thickness is calculated from the vernier setting. Measurements are accurate to within one to three percent of wall thickness.

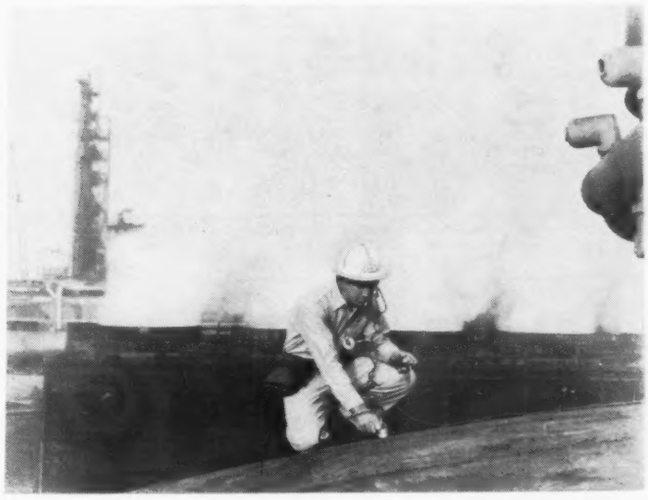
For greater accuracy (0.1 to 1 percent) and literally instantaneous, automatic readings, a larger instrument is used. This instrument indicates measured thickness on a 14 or 21-in. cathode-ray tube as soon as the transducer is applied. No calculations are necessary.

Surveys using the larger device are completed most quickly by a two-man team communicating through sound-powered telephones; they can take hundreds of readings in a short time. The more experienced operator usually watches the instrument screen and logs readings, while his assistant works up to 1000 ft away with the transducer connected to an extension cable.

The instrument transforms 110-v, 60 cycle a-c into continuously varying electrical frequencies ranging from 0.7 mc to 25 mc. These oscillations are amplified and fed to a piezoelectric transducer, which converts them into ultrasonic vibrations — sound at frequencies above the range of hearing— and sends them into the metal under test. Plate current increases sharply when transducer frequency matches the test part's resonant frequency, and shows as one or more vertical traces on the cathode-ray screen. Suitably calibrated scales placed before the screen allow instantaneous thickness readings.

Readings are not thrown off by internal scale deposit. Some types of instruments will average out thickness of tube and scale, equating a thin-walled, heavily scaled pipe to a heavy-walled pipe free of deposits. An ultrasonic resonance gage, however, measures only the uncorroded metal.

Although a precision instrument, the ultrasonic resonance gage is rugged, and will withstand rough field usage. The gas distribution industry has found it to be another product of modern electronics that can do a better job more quickly, with less effort, and at lower cost. * * *



Two-man team can quickly check vast area of tank surface with ultrasonic gage. At left, trained operator notes instantaneous thickness reading on screen while assistant (right) applies probe to metal at distances up to 1000 ft away. Men communicate via sound-powered telephones.

Nationwide Survey by A.G.A. Task Force reveals interesting new data on . . .

External Corrosion of Gas Meters

J. G. Surchek, *Dearborn Chemical Company, Chicago, Illinois*

EXTERNAL CORROSION OF GAS METERS and protective coatings to prevent it are always good subjects for discussion, particularly among gas distribution meter men and gas distribution company corrosion engineers. That problems in external protection of gas meters exist has long been recognized but the extent of the problem was not known until recently, when results were presented of a survey made by a Task Force group of the Aboveground Subcommittee of the Corrosion Committee, Operating Section, American Gas Association.

The survey was conducted on a nationwide basis. Questions asked included details on types of meters, used, where meters were installed, corrosion problems encountered, causes of corrosion, types of coatings used, how applied, and experiences with such coatings.

Replies were received from 30 gas distribution companies, and the response, geographically, was fairly representative. Detailed information is given in the accompanying table. A summary of the survey is given below.

General Analysis by Areas

West Coast Area. Tin case meters are in greatest use with iron hard case meters running a second. Within the age change period varying from 6 to 15 years corrosion was reported in all cases but incidence was low. Meters were generally installed outside and corrosion occurred in those cases. Causes of corrosion were wet ground, outdoor weathering, dampness in beachfront areas. Two companies used oil paints, one a vinyl combination. Application was cold spray. Although two companies were satisfied with their present system all were testing new coatings.

Great Plains Area. Within age change period, only one reported corrosion. Meters were apparently divided 50-50 between indoor and outdoor installations. Synthetic oil paints were mostly used, one company reporting that no coating was used. Significantly only one company reported small corrosion. None of the companies were testing new coatings and were satisfied with what they were using.

Central States Area. Tin case meter used predominately. Within age change period of 10 years only two out of seven reported significant corrosion. Meters were installed inside. Cause of corrosion, damp basements. Coating systems were oil paints, epoxy paint, vinyl coating. All were satisfied with their systems, four reporting no trials with new systems.

North East States. Meters generally installed inside. Corrosion reported as low—caused by damp basements. Two companies reported satisfaction with

Here's What the Task Force Survey Revealed

Company No.	Area	Number of Meters	Type of Meter (percent)			Age Change Period (Years)	Experience Corrosion?	Percent of Corrosion	Where Installed		Most Frequent Corrosion Problem				Cause of Corrosion
			Tin	Hard Case (Al)	Hard Case (Iron)				Inside	Outside	Inside	Outside	Residential	Industrial	
1		90,000	91	8	1	15	Yes	1	15	85		X	X	X	Wet ground
2	West	75,000	59	28	13	6	Yes Small	—	20	80		X	X Outside	X	Outdoor weathering
3	Coast	1,670,000	50	—	50	10	Yes	50 mild Few severe	10	90		X	X		Moisture—damp or beachfront area
4	Plains	140,081	77.5	12.4	10.1	10	Yes	2	70	30	X			X	Meters in pits, damp basements, electrolysis on damp ground.
5	Area	54,000		26	74	7	No	—	50	50			X		Damp locations
6		385,000	—	—	—	8	No	—		100		X		X	Outdoor weathering
7		85,640	5	12	83	7	No	—	73	27		X	X		Contact with soil
8		1,015,000	98.52	1.4	.08	10	Yes	.1	100	0	X		X		Damp locations, occasional industrial process
9	Central States	124,000	0	10	90	10	Yes 7-8 years	50	10	90		X	X		Moisture or weather
10	Great	780,000	75	23	2	10	Yes	10	96	4	X		X		Bad painting
11	Lakes	250,000	65	30	5	10	No	0	90	10					
12	Area	153,000	—	—	—	10	Yes	.25	80	20		X	X		Dampness—poor paint application
13		371,000	92	4	4	10	Yes	.1	95	5	X		X		Damp basements
14		476,975	32	8	60	10	No	0			X				
15	North	105,000	70	10	20	7	Yes	1	95	5		X	X		Condensation
16	Coast	250,000	30	30	40	8	No		2	98					
17	States	252,000	43	17	40	8	Yes	?	85	15	X		X		Damp basements
18		208,000	98	0	2	8	Yes	.7	100	0	X		X		Damp basements against white washed walls
19		4,000				10	Yes	10	90	10		X	X		
20	Eastern	320,000	94	4	2	7	No		100		X		X		Cold and damp basements
21	Seaboard	1,125,000	100	0	0	6	No		100			X			Moisture & corrosive atmosphere
22		300,000	70	20	10	7	Yes	2	70	30		X	X		Outdoor weathering on shore areas Prep. of surface more of problem
23		1,360,000	99.6	.3	.1	7	Yes	Slight	100		X		No diff.		Damp cellars
24		390,000	90.0	.5	9.5	16	Yes	8	99.48	.52	X		X		
25		382,000	99.7	.2	.1	6–10	Yes	8.6	96.3	3.7		X	X		Dampness
26		250,000	97.75	2.00	.25	6	Yes	.3	100		X		X		
27	S. E.	43,000	74	4	22	8	Yes	—	74	26		X		X	Poor painting
28	States	350,000	—	—	—	12	Slight					X	X	X	Poor paint application—Ind. fumes
29	Gulf	200,000	7.5	27.5	65.0	10–17	Yes	5			X			X	Gulf climate
30	Area	370,000				10–15	Yes	75	1	99		X			Gulf climate—High humidity

present systems. One was dissatisfied but had no new trials on coatings.

Eastern Seaboard. Tin case meters installed inside. Four reported significant corrosion. Five reported damp basements as cause. All were satisfied with their coating system with one exception.

South Eastern States. Only slight corrosion reported although meters were installed outside. Both companies were satisfied with their coatings and were not running any new trials on coatings.

Gulf Area. One initially reported 75 percent of meters were corroded within their 10 to 15 year change period. Meters are set outside and corrosion is attributed to the Gulf climate. Corrosion appears to be a problem here.

Discussion

External corrosion of meters does not appear to be a general nationwide problem. The type of meter has little bearing on the problem because difficulties are experienced with all types. The contributing factors appear to be the general exposure area and the location of the meters.

General Conclusions

The following general conclusions are drawn on the basis of the questions asked in the survey questionnaire.

1. **Are meter people encountering serious external corrosion on a nationwide basis?**

It does not appear that external corrosion is a serious nationwide problem. This is indicated by the general lack of response to the questionnaire. In addition to this the responses indicate that corrosion difficulties are peculiar to certain geographical areas where outside meter sets are exposed to weather conditions which are severe. Thus the corrosion problem is not universal but a local geographical one.

2. **Can corrosion difficulties be related to the type of meter used?**

There is no correlation possible in the information offered to indicate that corrosion can be attributed to the type of meter used.

3. **How serious is the corrosion?**

Generally speaking those companies with outside meter sets operating under severe atmospheric conditions encounter the greatest number of corrosion difficulties. It appears that where there are inside meter sets there are very few problems. Damp basements however are the most frequent causes of corrosion in these instances.

4. **Can corrosion difficulties be attributed to the type of exposure condition?**

Yes. Most of the corrosion difficulties occur under severe outdoor weathering conditions or in contact with wet soil. As stated above inside sets do not generally pose a problem.

5. **What type of coatings are used and are they considered adequate on the basis of experience?**

Of the 30 responses, only 3 companies indicated that they were not satisfied with their present coating systems. On the whole the results indicate that the majority of the companies use an oil paint system. Two vinyl systems and one epoxy paint system are reported which are significantly different from the oil paint systems which include the alkyd enamels.

6. **Are application techniques a factor in contributing to corrosion difficulties?**

It is apparently a factor but not too prevalent. Five out of 30 of the companies report that poor painting application was the cause of their corrosion difficulties.

7. **Would recommendations on coatings and their application be helpful to the meter people?**

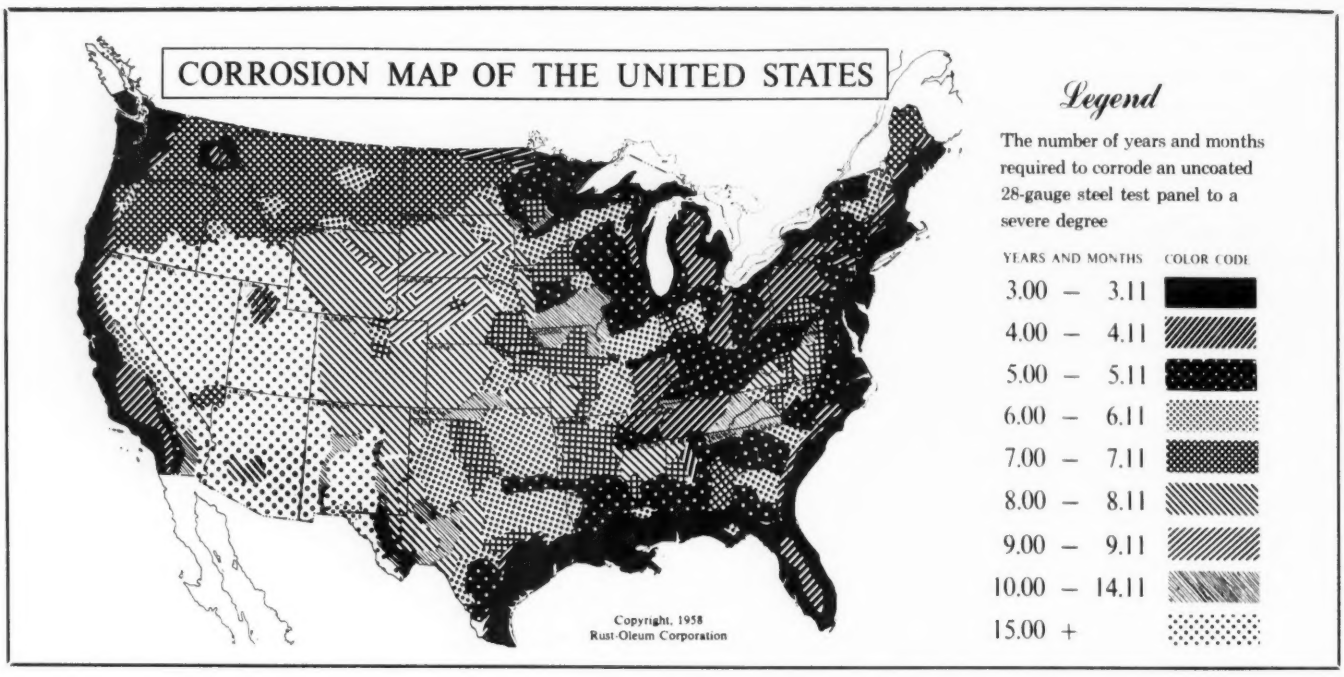
Only 2 companies reported that they would be interested in such type of information. It is significant that although most companies are satisfied with their present systems of protection, one-half of them are continuing tests on their own, evaluating new coatings for improved performance.

External corrosion of gas meters, apparently, is not a universal problem. It appears, however, that corrosion problems are severe in certain geographical areas particularly in the coastal areas where meters are exposed to outdoor weathering conditions or in contact with wet soil.

Acknowledgment

This article adapted from a presentation by the author at the 1958 A.G.A. Distribution Conference.

Company No.	Type of Coating	How Applied	Surface Preparation	New Trials On Coatings?	Experience With Present Coating	Interested In Coating Research?
1	Oil Paint	Cold Spray	Strip	Yes—color only	OK	Yes
2	Alkyd-No Primer	Cold Spray	Strip & Solvent	Yes	OK	Yes
3	Vinyl Primer & Enamel 2 mils	——	Caustic Strip	Yes	Looking for better	Yes
4	Oil Paint	Brush	Solvent—Wire Brush	No	OK for 0-6 years	Yes
5	Oil Paint & Aluminum	Spray Brush	Water Wash	No		Yes
6	Synthetic oil Resin & Asphalt	Spray	Strip & Sandblast	No	OK as is	No
7	None			No		Yes
8	Enamel	Brush or Dip	None	No	OK as is	Yes
9	Two Coat Vinyl Al	Brush	Strip & Solvent	Yes	OK as is	Yes
10	Oil Paint	Spray	Strip	Yes	OK as is	Yes
11	Oil Paint 3 mils	Spray Brush	Strip	No	OK as is	Yes
12	Epoxy Resin Paint	Brush Spray	Detergent	No	OK as is	Yes
13	Hi Solid 2 mils Alkyd	Cold Spray	Strip	Yes	OK as is	Yes
14	Oil Paint 1.5 mils Rubber Base	Spray	Detergent	No	OK as is	Yes
15	Oil Paint	Spray	Solvent	No	Not looking for new coatings	Yes
16	Vinyl 1 mil	Spray	Wheelabrator	Yes	OK as is	Yes
17	Oil Paint 2 mils	Spray	Strip	Yes	OK as is	Yes
18	Oil Paint	Spray	Strip & Solvent	No	OK for inside if go to outside would want more experience	Yes
19	Oil Paint & Vinyl 2-3 mils	Spray Brush	Solvent	Yes	No	Yes
20	Oil Enamel	Brush	Solvent	No	OK as is	Yes
21	Oil Paint—one coat	Electrostatic Spray	Solvent	No	OK as is	No
22	Oil Paint	Spray	Solvent	Yes	OK as is	Yes
23	Oil Paint 2¼ mils	Spray	Degreaser	No	OK as is	Yes
24	Oil Paint 2 mils	Spray	Strip	Yes	OK as is	Yes
25	Several types meter paints 1 mil	Spray	Strip	Yes	OK on inside No on outside	Yes
26	Baked Enamel	Spray	Strip & Phosphate	No	OK as is	Yes
27	Aluminum Paint 1 mil	Brush	Brush	No	OK as is	No
28	Paint 10 mils	Spray Brush	Solvent	No	OK as is	Yes
29	Primer with Al Paint 3 mils	Spray	Wire Brush	Yes	OK as is	Yes
30	Oil Paint 1-3 mils	Spray	——	Yes	No	Yes



25-Year Research Program Results In First Comprehensive . . .

Corrosion Rate Index For U. S. Cities

COMPARATIVE RATES AT WHICH CORROSION TAKES PLACE in different parts of the U. S. has been established for the first time as the result of a 25-year research program conducted by the Rust-Oleum Corporation of Evanston, Illinois.

The index, which includes 523 U. S. cities with population of more than 10,000, is published in its entirety in this issue of AMERICAN GAS JOURNAL through the courtesy of Rust-Oleum Corporation.

Fastest corrosion rate noted in the study is three years — in four different cities, Buffalo and Rochester, New York; Erie, Pennsylvania; and Miami, Florida — while the slowest corrosion rate, more than 15 years, is reported for Tuscon, Arizona, and Roswell and Santa Fe, New Mexico.

The index was compiled by exposing dated, uncoated steel panels to atmospheric conditions in cities throughout the nation. The panels were 28-gage, low carbon, cold roll sheet steel, the size of an automobile license plate. Periodic examination of the panels provided data for the index. Criterion for the index was the time it took for the uncoated steel panel to corrode to a severe degree.

Variations in rate among cities results from different amounts of rainfall, wind, corrosive gases, sunlight, salt water, and other factors present in the atmosphere at each test site.

Of the 523 cities listed, 221 (42 percent) are indexed as Class I, indicating that corrosion time was less than four years. Class I includes every major U. S. industrial area and most secondary industrial centers. In Class II, four to five years, are 95 cities. The 316 cities in Classes I and II comprise 60 percent of the U. S. cities with population over 10,000.

CLASS	RUST-INDEX Years-Months
1	3.00- 4.00
2	4.01- 5.00
3	5.01- 6.00
4	6.01- 7.00
5	7.01- 8.00
6	8.01- 9.00
7	9.01-10.00
8	10+
9	10+
10	10+
11	15+
12	15+

CITY	CLASS	RUST-INDEX Years-Months
ALABAMA		
Anniston	3	5.04
Bessemer	2	4.04
Birmingham	2	4.04
Dothan	5	7.10
Florence	4	6.08
Gadsen	3	5.10
Huntsville	5	7.06
Mobile	1	3.01
Montgomery	3	5.06
Tuscaloosa	5	7.03
ARIZONA		
Phoenix	6	8.09
Tucson	11	15+
ARKANSAS		
Hot Springs	5	7.03
Little Rock	4	6.09
North Little Rock	4	6.09
Pine Bluff	5	7.11
CALIFORNIA		
Alameda	1	3.11
Alhambra	1	3.10
Anaheim	1	3.10
Arcadia	1	3.11
Bakersfield	2	4.05
Berkeley	1	3.11
Beverly Hills	1	3.10
Burbank	1	3.10
Chula Vista	1	3.11
Culver City	1	3.10
Daly City	1	3.10
East Bakersfield	2	4.05
Eureka	1	3.11
Fresno	2	4.05
Fullerton	1	3.10
Glendale	1	3.11
Hawthorne	1	3.09
Hayward	1	3.11
Huntington Park	1	3.11
Long Beach	1	3.11
Los Angeles	1	3.02
Lynwood	1	3.11
Manhattan Beach	1	3.11
Montebello	1	3.11
Monterey Park	1	3.11
National City	1	3.10
Oakland	1	3.08
Ontario	1	3.11
Oxnard	1	3.10
Palo Alto	1	3.10
Pasadena	1	3.08
Pomona	1	3.11
Redwood City	1	3.11
Richmond	1	3.11
Sacramento	3	5.05
San Bernardino	1	3.11
San Diego	1	3.09
San Francisco	1	3.09
San Jose	1	3.10
San Leandro	1	3.09
Santa Barbara	1	3.10
Santa Clara	1	3.10
Santa Monica	1	3.10
South Gate	1	3.10
Stockton	1	3.11
Sunnyvale	1	3.08
Vallejo	1	3.08
West Covina	1	3.08
Whittier	1	3.11
COLORADO		
Colorado Springs	4	6.10
Denver	5	7.02
Pueblo	5	7.03
CONNECTICUT		
Bridgeport	1	3.11
Bristol	1	3.11
Danbury	2	4.05
East Hartford	2	4.04
Fairfield	1	3.09
Greenwich	1	3.09
Hamden	2	4.04
Hartford	2	4.03
Manchester	2	4.04
Meriden	1	3.11
Middletown	1	3.09
Milford	1	3.11
New Britain	1	3.09
New Haven	1	3.10
New London	1	3.08
Norwalk	1	3.11
Norwich	1	3.09
Stamford	1	3.09
Stratford	1	3.10
Torrington	2	4.04
Waterbury	2	4.03
West Hartford	1	3.10
West Haven	1	3.09
DELAWARE		
Wilmington	1	3.11
DISTRICT OF COLUMBIA		
Washington	2	4.03
FLORIDA		
Coral Gables	1	3.08
Daytona Beach	1	3.07
Gainesville	2	4.03
Hialeah	1	3.09
Jacksonville	1	3.04
Key West	1	3.07
Lakeland	2	4.03
Miami	1	3.00
Orlando	2	4.01
Pensacola	1	3.01
St. Petersburg	1	3.09
Tallahassee	2	4.04
Tampa	1	3.07
GEORGIA		
Albany	3	5.10
Athens	3	5.11
Atlanta	1	3.03
Augusta	3	5.06
Columbus	5	7.07
La Grange	5	7.07
Macon	4	6.08

CITY	CLASS	RUST-INDEX Years-Months
Rome	4	6.01
Savannah	1	3.09
IDAHO		
Boise	4	6.09
Pocatello	7	9.06
ILLINOIS		
Alton	2	4.01
Aurora	3	5.01
Belleville	3	5.02
Berwyn	2	4.02
Bloomington	3	5.08
Champaign	4	6.11
Chicago	1	3.05
Cicero	1	3.05
Danville	4	6.09
Decatur	4	6.10
Elgin	3	5.09
Elmhurst	3	5.10
Evanston	1	3.10
Galesburg	3	5.08
Granite City	2	4.05
Joliet	2	4.05
Kankakee	3	5.10
Maywood	3	5.08
Moline	2	4.04
Oak Park	2	4.05
Pekin	2	4.04
Peoria	2	4.03
Quincy	2	4.04
Rockford	3	5.01
Rock Island	2	4.04
Skokie	2	4.05
Springfield	5	7.05
Waukegan	1	3.10
INDIANA		
Anderson	3	5.10
Bloomington	4	6.09
East Chicago	1	3.07
Elkhart	3	5.07
Evansville	2	4.04
Fort Wayne	4	6.06
Gary	1	3.08
Hammond	1	3.08
Indianapolis	3	5.03
Kokomo	5	7.09
Lafayette	4	6.06
Marion	5	7.09
Michigan City	2	4.04
Mishawaka	1	3.11
Muncie	5	7.09
New Albany	2	4.04
Richmond	6	8.02
South Bend	1	3.10
Terre Haute	3	5.03
IOWA		
Burlington	3	5.10
Cedar Rapids	4	6.06
Clinton	3	5.10
Council Bluffs	3	5.11
Davenport	3	5.04
Des Moines	3	5.03
Dubuque	3	5.05
Fort Dodge	5	7.11
Iowa City	6	8.01
Mason City	5	7.11
Ottumwa	5	7.11
Sioux City	4	6.06
Waterloo	4	6.06
KANSAS		
Hutchinson	6	8.05
Kansas City	4	6.05
Salina	4	6.10
Topeka	4	6.09
Wichita	5	7.09
KENTUCKY		
Ashland	3	5.04
Covington	2	4.03
Lexington	4	6.07
Louisville	1	3.11
Newport	1	3.11
Owensboro	2	4.10
Paducah	3	5.05
LOUISIANA		
Alexandria	3	5.04
Baton Rouge	1	3.02
Lafayette	1	3.02
Lake Charles	1	3.06
Monroe	3	5.06
New Orleans	1	3.01
Shreveport	2	4.04
MAINE		
Bangor	3	5.01
Lewiston	1	3.05
Portland	1	3.05
MARYLAND		
Baltimore	1	3.03
Cumberland	5	7.10
Hagerstown	3	5.03
MASSACHUSETTS		
Arlington	1	3.11
Belmont	1	3.10
Beverly	1	3.10
Boston	1	3.10
Brockton	1	3.10
Cambridge	1	3.11
Chelsea	1	3.11
Chicopee	2	4.02
Everett	1	3.10
Fall River	1	3.11
Fitchburg	2	4.03
Framingham	1	3.10
Gloucester	1	3.09
Haverhill	1	3.11
Holyoke	2	4.04
Lawrence	1	3.11
Lowell	1	3.11
Lynn	1	3.11
Malden	1	3.10
Medford	1	3.11
Melrose	1	3.11
New Bedford	1	3.10
Newton	1	3.10
Northampton	2	4.05
Pittsfield	3	5.08
Quincy	1	3.10
Revere	1	3.10
Salem	1	3.09
Somerville	1	3.10
Springfield	1	3.10
Taunton	1	3.09
Waltham	1	3.08
Watertown	1	3.11
Weymouth	1	3.11
Worcester	1	3.11
MICHIGAN		
Ann Arbor	2	4.09
Battle Creek	2	4.09
Bay City	1	3.11
Dearborn	1	3.08
Detroit	1	3.08
Ferndale	1	3.11
Flint	1	3.11
Grand Rapids	1	3.09
Hamtramck	1	3.11
Highland Park	1	3.09
Jackson	3	5.07
Kalamazoo	3	5.06
Lansing	2	4.03
Muskegon	1	3.09
Pontiac	1	3.11
Port Huron	1	3.08
Royal Oak	1	3.08
Saginaw	1	3.10
St. Joseph	2	4.03
Wyandotte	1	3.11
MINNESOTA		
Duluth	1	3.09
Minneapolis	2	4.11
Richfield	3	5.07
Rochester	4	6.08
St. Cloud	5	7.07
St. Louis Park	3	5.06
St. Paul	2	4.11
Winona	3	5.02
MISSISSIPPI		
Biloxi	1	3.10
Greenville	4	6.04
Hattiesburg	2	4.10
Jackson	5	7.10
Laurel	3	5.08
Meridian	3	5.07
Vicksburg	3	5.06
MISSOURI		
Columbia	7	9.06
Independence	4	6.05
Jefferson City	5	7.09
Joplin	5	7.09
Kansas City	3	5.07
St. Louis	1	3.10
Springfield	5	7.04
University City	2	4.05
MONTANA		
Billings	4	6.09
Butte	4	6.09
Great Falls	5	7.10
NEBRASKA		
Lincoln	5	7.09
Omaha	4	6.07
NEVADA		
Las Vegas	5	7.10
NEW HAMPSHIRE		
Concord	3	5.06
Manchester	3	5.09
Nashua	2	4.04
NEW JERSEY		
Atlantic City	1	3.03
Bayonne	1	3.06
Belleville	1	3.08
Bloomfield	1	3.08
Camden	1	3.11
Clifton	2	4.03
East Orange	2	4.03
Elizabeth	2	4.02
Garfield	2	4.01
Hackensack	1	3.07
Hamilton	2	4.03
Hoboken	1	3.08
Irvington	2	4.03
Jersey City	1	3.08
Kearny	1	3.09
Linden	2	4.05
Maplewood	2	4.05
Montclair	2	4.06
Newark	1	3.08
New Brunswick	1	3.10
North Bergen	2	4.05
Nutley	2	4.05
Orange	2	4.05
Passaic	1	3.07
Paterson	1	3.07
Perth Amboy	1	3.08
Plainfield	2	4.02
Teaneck	2	4.02
Trenton	1	3.11
Union	2	4.06
Union City	1	3.11
West New York	2	4.02
West Orange	2	4.05
Woodbridge	2	4.06
NEW MEXICO		
Albuquerque	9	10+
Roswell	11	15+
Santa Fe	11	15+
NEW YORK		
Albany	3	5.07
Amsterdam	3	5.08
Auburn	2	4.04
Binghamton	4	6.08
Buffalo	1	3.00
Elmira	3	5.08
Hempstead	1	3.08
Ithaca	3	5.08
Jamestown	2	4.10
Kingston	3	5.09
Lackawanna	1	3.06
Lockport	1	3.06
Mount Vernon	2	4.04
Newburgh	3	5.09
New Rochelle	2	4.10
New York	1	3.06
Niagara Falls	1	3.07
Poughkeepsie	3	5.10
Rochester	1	3.00
Rome	3	5.09
Schenectady	3	5.06
Syracuse	1	3.11
Troy	2	4.10
Utica	3	5.09
Valley Stream	2	4.10
Watertown	2	4.10
White Plains	1	3.11
Yonkers	1	3.11
NORTH CAROLINA		
Asheville	5	7.05
Charlotte	4	6.06
Durham	5	7.05
Fayetteville	2	4.09
Gastonia	4	6.07
Greensboro	4	6.07
High Point	4	6.07
Kannapolis	5	7.05
Raleigh	3	5.10
Rocky Mount	3	5.10
Wilmington	1	3.11
Winston-Salem	4	6.06
NORTH DAKOTA		
Fargo	4	6.11
Grand Forks	5	7.02
OHIO		
Akron	3	5.06
Alliance	2	4.11
Barberton	3	5.06
Canton	3	5.06
Cincinnati	2	4.11
Cleveland	1	3.03
Cleveland Heights	1	3.03
Columbus	3	5.01
Cuyahoga Falls	3	5.11
Dayton	2	4.11
East Cleveland	1	3.03
Elyria	1	3.03
Euclid	1	3.03
Hamilton	1	3.11
Kettering	2	4.08
Lakewood	1	3.05
Lima	3	5.01
Lorain	2	4.09
Mansfield	3	5.05
Marion	2	4.09
Massillon	3	5.06
Middletown	2	4.10
Newark	4	6.08
Norwood	2	4.10
Parma	1	3.11
Portsmouth	3	5.10
Sandusky	2	4.09
Shaker Heights	1	3.03
Springfield	2	4.10
Steubenville	2	4.08
Toledo	1	3.10
Warren	2	4.08
Youngstown	1	3.03
OKLAHOMA		
Enid	4	6.07
Lawton	5	7.04
Muskogee	4	6.07
Norman	4	6.05
Oklahoma City	4	6.05
Tulsa	4	6.07
OREGON		
Eugene	3	5.06
Portland	1	3.04
Salem	3	5.06
PENNSYLVANIA		
Aliquippa	2	4.10
Allentown	1	3.11
Altoona	2	4.08
Bethlehem	1	3.11
Chester	2	4.09
Easton	2	4.08
Erie	1	3.00
Harrisburg	1	3.11
Hazelton	3	5.06
Johnstown	1	3.03
Lancaster	2	4.11
Lebanon	3	5.05
McKeesport	2	4.09
New Castle	3	5.03
New Kensington	2	4.08
Norristown	1	3.02
Philadelphia	1	3.08
Pittsburgh	1	3.01
Reading	1	3.06
Scranton	1	3.07
Sharon	1	3.05
Washington	2	4.04
Wilkes-Barre	2	4.03
Wilkinsburg	1	3.05
Williamsport	5	7.02
York	3	5.10
RHODE ISLAND		
Cranston	1	3.09
East Providence	1	3.10
Newport	1	3.06
Pawtucket	1	3.11
Providence	1	3.04
Warwick	1	3.06
Woonsocket	1	3.11
SOUTH CAROLINA		
Charleston	1	3.09
Columbia	4	6.08
Greenville	5	7.04
Spartanburg	5	7.04
SOUTH DAKOTA		
Sioux Falls	4	6.08
TENNESSEE		
Chattanooga	4	6.08
Jackson	4	6.07
Johnson City	6	8.03
Knoxville	2	4.05
Memphis	3	5.10
Nashville	2	4.04
Oak Ridge	2	4.04
TEXAS		
Abilene	8	10+
Amarillo	5	7.01
Austin	5	7.01
Beaumont	2	4.04
Brownsville	1	3.11
Corpus Christi	1	3.09
Dallas	4	6.10
El Paso	4	6.10
Fort Worth	4	6.10
Galveston	1	3.06
Houston	1	3.03
Laredo	3	5.11
Lubbock	5	7.09
Odessa	6	8.06
Port Arthur	1	3.09
San Angelo	7	9.08
San Antonio	3	5.10
Temple	7	9.08
Tyler	4	6.11
Waco	3	5.11
Wichita Falls	6	8.07
UTAH		
Ogden	5	7.10
Provo	5	7.10
Salt Lake City	2	4.05
VERMONT		
Burlington	1	3.07
VIRGINIA		
Alexandria	2	4.04
Charlottesville	5	7.10
Danville	6	8.07
Lynchburg	6	8.07
Newport News	1	3.06
Norfolk	1	3.02
Petersburg	3	5.10
Portsmouth	1	3.06
Richmond	3	5.09
Roanoke	5	7.10
WASHINGTON		
Bellingham	1	3.06
Bremerton	1	3.07
Everett	1	3.07
Seattle	1	3.05
Spokane	2	4.11
Tacoma	1	3.11
Vancouver	1	3.07
Yakima	5	7.03
WEST VIRGINIA		
Charleston	3	5.08
Clarksburg	5	7.04
Fairmont	5	7.02
Huntington	3	5.04
Morgantown	5	7.02
Parkersburg	4	6.08
Wheeling	2	4.04
WISCONSIN		
Appleton	2	4.05
Beloit	4	6.07
Eau Claire	4	6.07
Fond du Lac	2	4.05
Green Bay	2	4.06
Kenosha	1	3.11
La Crosse	3	5.01
Madison	3	5.01
Manitowoc	1	3.06
Milwaukee	1	3.05
Oshkosh	2	4.05
Racine	1	3.11
Sheboygan	1	3.10
Superior	1	3.08
Wausau	4	6.09
Wauwatosa	1	3.11
West Allis	1	3.09
WYOMING		
Cheyenne	5	7.03

Hot Spot Protection For Bare Pipe

Properly applied, it can prevent up to 90 percent of leaks at cost of only 15 percent of complete protection

A. G. Prasil, *Engineering Staff,**
Southern Union Gas Company, Dallas, Texas

BARE PIPE will always corrode much more rapidly in certain sections than in others. Since it is rarely economical to place a bare line under complete cathodic protection, it becomes necessary to locate the "hot spots" in order to place the protection where it will do the most good. This protection, when properly applied to the "hot spot" areas, may be expected to prevent up to 90 percent of the leaks, at a cost of approximately 15 percent of that of complete protection.

Hot spots can be located by two methods. The first (and most reliable) is a soil resistivity survey. Most convenient method for making a survey of this type is by means of a single rod apparatus, which consists of a steel rod with a metal tip insulated from the rod proper, and a small battery powered alternating current bridge, using a pair of headphones to indicate balance. This apparatus is sometimes referred to as a "Sheppard's Cane."

When making the survey, readings should be taken near pipe depth and at intervals ranging from as little as 10 ft to as great as 200 ft. It is important to catch any significant changes. Visual inspection of the terrain usually will help to make sure that none are missed.

The values of soil resistivity obtained can be plotted on semilogarithmic paper as a resistivity profile of the line. The reason for using semilog paper is because percentage comparisons are the important consideration. Sudden dips in the resistivity profile indicate areas that require further investigation and probable protection.

Values of resistivity are an indication of the corrosivity of the soil. The following rules may be used for guidance:

1. **Values below 1000 ohm/cm.** are almost always corrosive. Except when they are relatively short sections lying between areas of still lower value, or when they comprise the highest values in a long section of line.

2. **Values above 10,000 ohm/cm.** are almost never corrosive; sometimes a short section of such soil will be somewhat corrosive when sections on either side have much higher values. Local cell action may also be a problem in these areas.

*Mr. Prasil was formerly an engineer with Wisconsin Public Service Company, Oshkosh, Wisconsin, a position he held when this article was prepared.

Applying Cathodic Protection to New Gas Mains

1. Top of pipe is cleaned prior to welding anode lead wire to it.

2. Lead wire is welded to pipe by a thermite-welding process.

3. **Values between 1000 and 10,000 ohm/cm.** must be interpreted by comparison with immediately adjacent sections. The low areas will be the corrosive sections.

Pipe-to-Soil Potential Method

The second method of locating "hot spots" is by means of a pipe-to-soil potential survey. Due to the fact that corrosion takes place when electrical currents leave the pipe at the anodic areas and return to it at cathodic areas, it is possible to detect these areas by means of a change in the potential drop through the soil. It is convenient to refer all soil potentials to that of the pipe itself because even quite large currents can produce relatively small potential differences in the metal compared to that through the soil.

Readings are taken using a potentiometer voltmeter combination, along with a copper-copper sulfate half cell as reference electrode. Readings are taken at the surface of the ground and directly above the pipe for the basic plot of the pipe to soil potential profile. In locating the anodic and cathodic sections, it may be of value to remember that — at the anode – the highest reading is directly over the pipe with lower readings on either side. At the cathode, the reverse is true, but the change in readings is not as great.

This type of survey is easier to make and can be made rapidly. If a trouble spot is located, it can be defined by a few additional readings. A distance of 100 ft between readings on coated lines and 50 ft on bare lines seems to be a good spacing for the initial survey work.

When the "hot spots" have been located along a bare line, current drainage of 2 milliamps per sq ft of pipe area to be protected should be provided. The amount of pipe of various sizes that can be protected by various size anodes is as follows:

Nominal Pipe Size (in.)	Spacing in feet for anode weights			
	9 lb	17 lb	32 lb	50 lb
4	22	41	78	121
6	15	28	53	82
8	11	21	40	63
10	9	17	32	50
12	8	14	27	43

These figures are based on 50 percent anode efficiency, 2 ma. per sq ft, and a 10-year anode life. If the conditions are such that the current output is higher than the 10-year rating, the anodes will protect a longer section of pipe for a shorter period of time and if the current output is less the anode lasts longer but protects a shorter section of pipe.

The normal 10-year-life ratings and the soil resistivities in which they are expected are:

Anode Size	Current for 10-Year Life (ma.)	Soil Resistivity (ohm/cm.)
9	51	3200
17	97	1900
32	183	1050
50	285	720

The tables above apply to one set of conditions, which are a 50 percent anode efficiency, isolated anodes, and 10-ft separation between pipe and anode. Higher efficiencies (which are commonly realized) will result in longer anode life. Grouping of anodes rather than single installation tends to restrict current flow. Placing anodes closer to the pipe increases current flow. However, most of the increased current will flow to the pipe in the immediate vicinity of the anode and as a result sections between anodes may not receive adequate protection.

One gas distribution company applied "hot spot" protection to 78,000 ft of bare 4-in., 31,000 ft of bare 6-in., 3500 ft of bare 8-in., and 8500 ft of bare 12-in. gas main at a cost of approximately $20,000. Leak records of previous years were not very adequate, but the number of leaks reported on protected lines dropped to almost nothing. On one stretch of 4-in. main almost 8 miles long, 11 corrosion leaks were reported during the two years prior to "hot spot' protection, but only three leaks were reported during the first year that protection was in effect, and no further leaks developed in the following two years. Other lines provided similar experience. The 8 and 12-in. pipe, which comprises a main booster line in one of the company's systems, had three corrosion leaks after "hot spot" protection was applied. This was a substantial drop from the previous experience on that line.

This company applies "hot spot" protection to all steel feeder lines that it does not expect to replace for capacity reasons within the next 10 years. It also installs anodes on 2-in. bare steel distribution systems whenever a leak is repaired, a service replaced, or whenever any work is done in advance of paving.

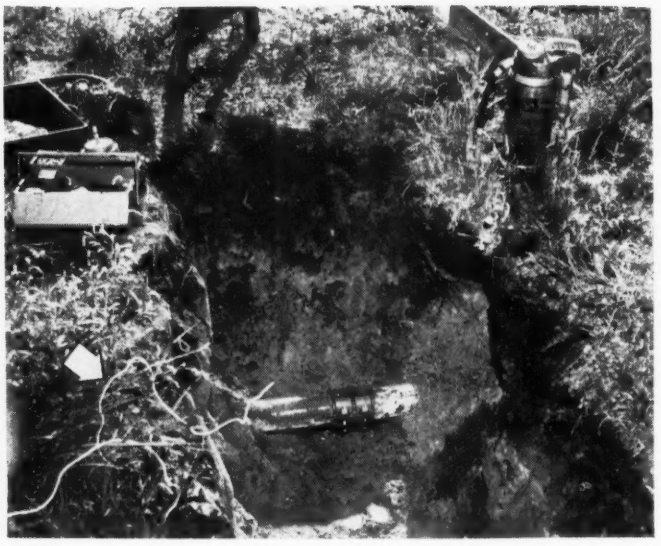
On-the-job photos show actual installation of magnesium anodes on a loop gas main. Anodes were installed every 150 ft. Cathodic protection afforded by the anodes is expected to add about 15 years of service life to the main. Step-by-step procedure is shown in the photos.

3. Wire gets protective wrapper, while protective coating is applied to weld and exposed pipe surface.

4. Laying anode in ditch completes anode installation.

Applying Hot Spot Protection While Making Leak Repair on Main

1 ◆



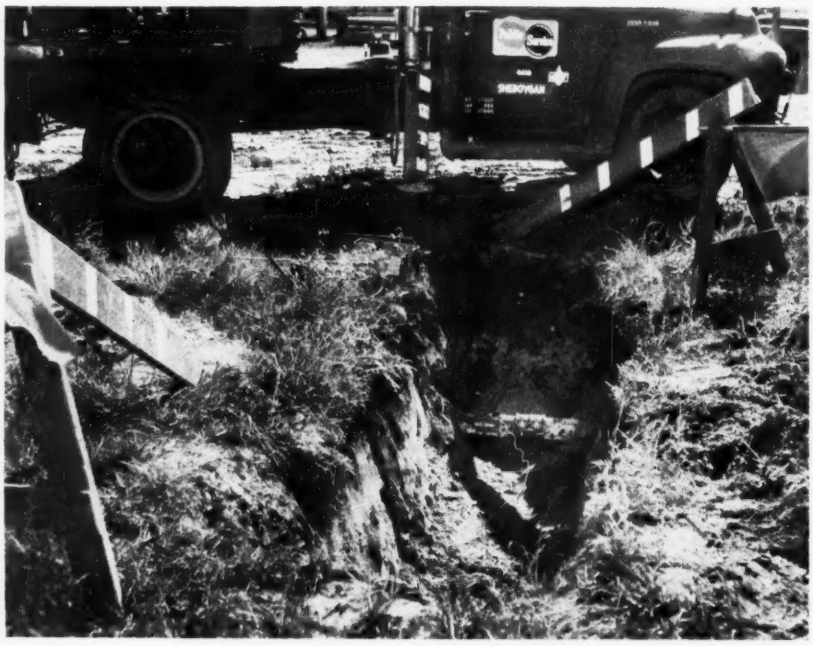
2 ◆

On-the-job photo sequence shows actual application of hot spot protection to bare steel gas main simultaneous with making a leak repair on the main. Step-by-step procedure shown in photos, is as follows: **1) One crewman makes test hole** with bar probe while other crewman takes gas sample from test hole. **2) Leak is located,** bellhole dug, and main repaired with leak clamp. Preparations are then made to install anode. Cadweld kit, used to weld lead to main, is at left background. Anode is out of sight at left foreground but lead wires are visible (arrow). Note fire extinguisher at right background, ready for emergency use. This is good practice. **3) Crewman cadwelds anode lead wire to main** while other crewman prepares to drop anode in hole dug with post hole auger. Distance from main to anode is about 6½ ft. Anode depth is about 15-in. from bottom of main to top of anode. Distances vary with main location, depending on proximity to pavement, type of soil, etc. Crewman making cadweld wears goggles — a "must" safety practice. **4) Weld is completed** and anode is placed in hole. Note that lead wire was wrapped around main to take strain off weld, prevent pulling loose. **5) Installation is completed** by covering anode, wrapping bare lead wire with rubber tape, and applying protective coating to repair sleeve, cadweld, and exposed main prior to backfilling.

3 ◆

4 ◆

5 ◆



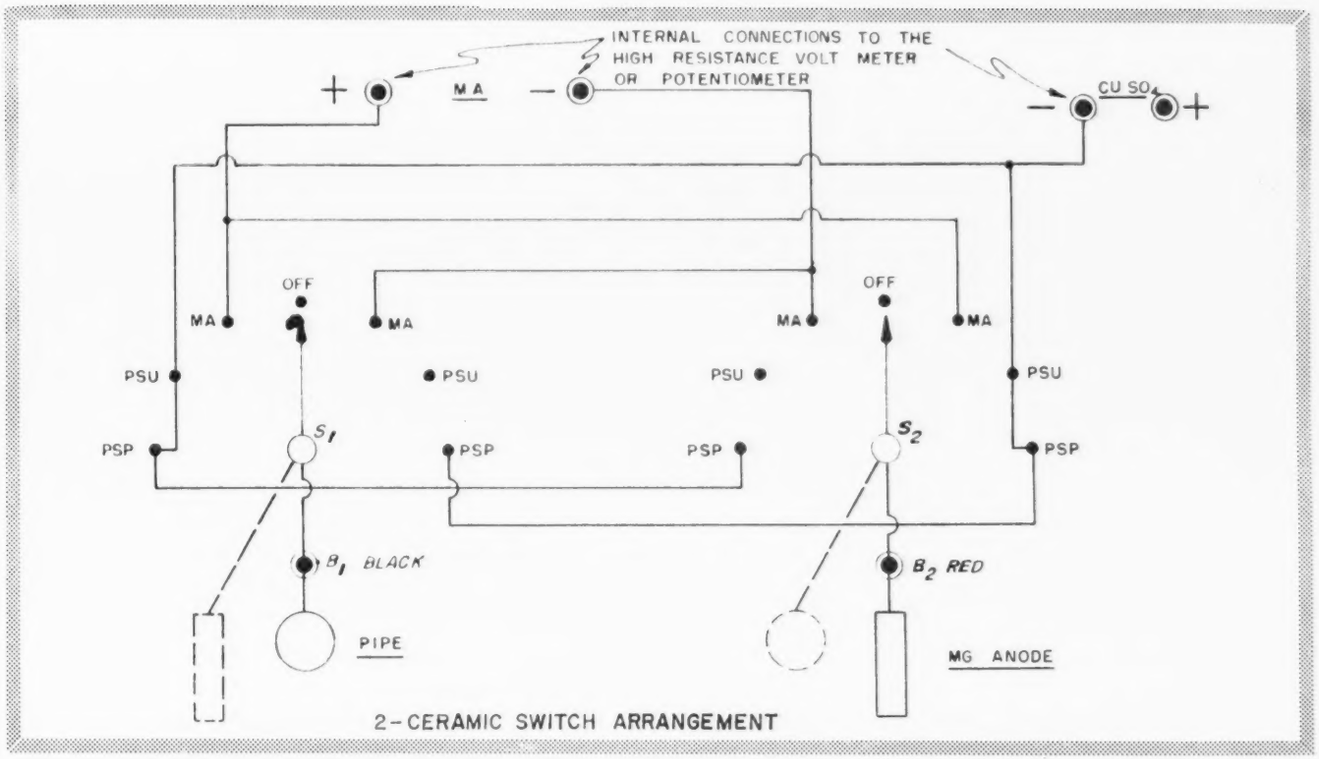


FIG. 1. **Schematic of "Outrigger"** showing arrangement of the two-pole, seven-position ceramic wafer switch.

'Outrigger' for Potentiometer Proves Real Time-Saver

L. E. Nichols, *Corrosion Engineer*
Northern Illinois Gas Company, Bellwood, Illinois

YOU CAN GET some idea of Northern Illinois Gas Company's distribution system — which spreads over 20 counties in Northern Illinois, serving over 625,000 customers in 273 communities — by noting that a new customer is added to its system every four minutes each working day. Such a pace over the past few years attests to the rapid growth of not only the company but also its operating problems.

For example, in 1957, NIG installed over 12,000 magnesium anodes during the installation of 2,700,000 ft of new main and for the protection of 136,000 ft of old distribution mains and services as well as hot spot protection. Of this, 3000 installations were provided with test facilities, i.e.: Wires brought to the surface and contained in a curb or valve box.

And, as of June 1958, there were approximately 32,000 test points throughout the company system from which at least one reading could be taken by the corrosion section.

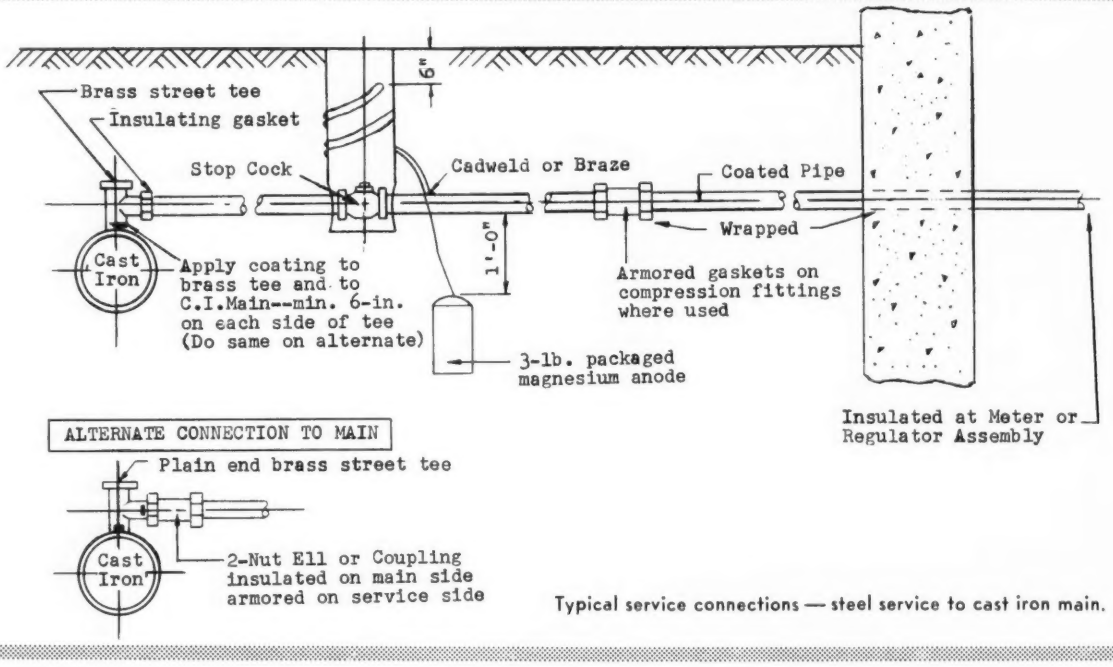
Even with tests grouped effectively as possible in such a wide spread territory, there was delay between notification of installation and time of test. Therefore, every effort had to be made to expedite all tests on the first trip, to forestall loss of test station by other excavations and improvements.

Data obtained on the first test, normally taken with a potentiometer, is the anode current output, the pipe-to-soil potential with the anode connected and disconnected. On such potentiometers as purchased it is usually necessary to juggle wires (as well as outsmart the gremlins that tangle wires) and to change terminals to get all three readings, since color coding is not followed. To expedite such data taking, the corrosion section personnel conceived, designed, attached, and put into operation *Outriggers* on the potentiometers used by them.

Wiring of the *Outrigger* is relatively easy with the ceramic wafer switch S_1 - S_2 connected straightforward, as shown on Fig. 1. This may be altered to give any sequence desired. The assembly of the *Outrigger* is relatively simple. Fig. 2 shows the attachment to

(Continued on page 31)

FIG. 2. **"Outrigger"** attached to potentiometer, ready to go to work.


Brass street tee
Insulating gasket
Stop Cock
Cadweld or Braze
Coated Pipe
Wrapped
Cast Iron
Apply coating to brass tee and to C.I.Main--min. 6-in. on each side of tee (Do same on alternate)
1'-0"
Armored gaskets on compression fittings where used
3-lb. packaged magnesium anode
Insulated at Meter or Regulator Assembly
ALTERNATE CONNECTION TO MAIN
Plain end brass street tee
Cast Iron
2-Nut Ell or Coupling insulated on main side armored on service side

Typical service connections — steel service to cast iron main.

Protecting Gas Services Against Corrosion

Keith A. Chen, *Administrative Engineer*
Milwaukee Gas Light Company, Milwaukee, Wisconsin

MOST GAS DISTRIBUTION COMPANIES today use steel pipe for gas service lines and such lines, properly protected, will have long life. While cathodic protection is one of the first considerations given to service line design, it is usually the last part of the installation.

To properly protect steel services, several basic considerations must be undertaken:

1. Service should be isolated electrically from other unprotected structures—such as unprotected mains, house piping in contact with water piping or any electrical grounding system, and structural metal framework.
2. Pipe must be adequately coated.
3. Local dissimilar metal cells should be eliminated.
4. Cathodic protection—using sacrificial anodes or rectifiers—should be used to supplement the coating.

Cathodic protection, it should be noted, is the "insurance policy" that provides the final measure of protection. Rectifiers, because of size, cost, and operating complexities, are not often used to protect service lines. Instead, sacrificial anodes are most commonly used to provide the necessary protection. The accompanying table outlines various requirements of cathodic protection systems for services using magnesium anodes.

Procedures for applying protection depend to a large degree on the type of main to which the service line is connected. Points that should be carefully checked are outlined in the following paragraphs.

Bare Steel Mains. Services connected to bare steel mains should be isolated from both the main and the house piping. Steel fittings should be used for connecting the service to the main. Any convenient place on the service line can be used as the insulating point. Anodes should be sized to adequately protect the line.

Coated Steel Mains. Services connected to coated steel mains are isolated at the connection to the main only if the service is to be given separate protection. Such isolation is advantageous in that it appreciably reduces the possibility of shorts between the main and nearby structures. It is disadvantageous in that it requires installation of individual anodes on each service line.

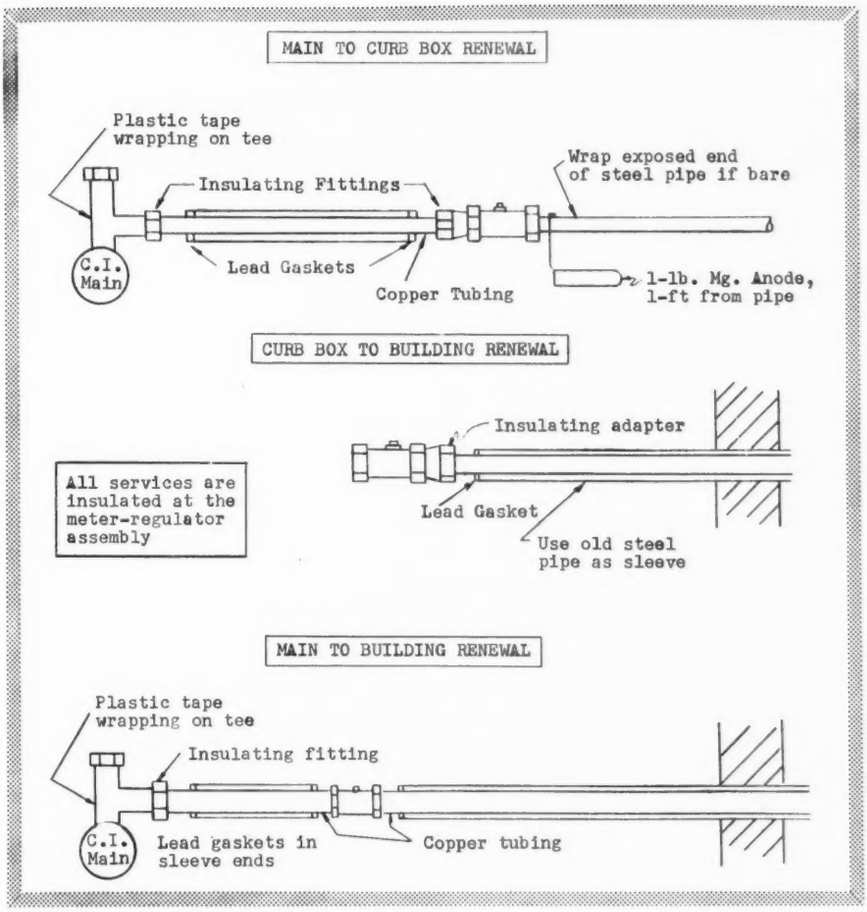
More common practice is joint protection of mains and services, which permits use of rectifiers instead of anodes, or the use of much larger anodes — which are more efficient, have higher output, and can be replaced much more easily than would be possible by using many smaller anodes.

Cast Iron Mains. Services connected to cast iron mains should be isolated at the outlet side of the street tee, and isolated at the point of connection to the meter or meter-regulator set. The steel service should be electrically continuous between points of isolation, by using compression fittings with armored gaskets or bond wires, or by using welded joints. Protection is completed by adding a packaged anode of proper size.

Main Connections. Even though one of the basic objectives of a planned corrosion prevention program is to eliminate dissimilar metal cells, this idea is subject to deviation by use of the brass tee for connecting services

CATHODIC PROTECTION CHART
Magnesium Anode System

Type of Main to which service is connected	Insulating fitting at main?	Insulating fitting at meter set?	Size of Anode Required	Remarks
Bare Steel	Yes	Yes	3 or 5-lb	
Coated Steel (unprotected)	Yes	Yes	3 or 5-lb	Use if service to be protected separately
Coated Steel (unprotected)	No	Yes	9 to 32-lb	Use if service and main are to be protected together
Coated Steel (protected)	Yes	Yes	3 or 5-lb	If separate protection desired
Coated Steel (protected)	No	Yes	none	Joint protection
Cast Iron	Yes	Yes	3 or 5-lb	



Typical service line renewals using copper tubing.

to cast iron main. This is a compromise measure. Brass is chosen over wrought or malleable iron because it is cathodic to the cast iron, and although the cast iron main is subjected to galvanic action, such action is negligible because the anode to cathode area ratio is heavily in favor of the anodic cast iron. Cell action is also reduced by coating the brass tee and the main for at least 6-in. on each side of the main. In all cases, the brass-to-steel connection should be insulated.

Points to Check to Insure Protection. Here are some items that should be checked to make sure that the installed line is properly protected:

1. Be sure that insulating fittings at meter-regulator end of service are not shorting.
2. Check house piping to make sure that it does not touch any service piping ahead of the meter. Make sure householder does not lay metal objects across the service line.
3. Make sure that all connections are either definitely insulating or definitely electrically continuous. Test all insulating fittings before backfilling. Use armored gaskets or bond wires across compression fittings, and make sure pipe is clean for good contact.
4. Use native backfill around anodes.
5. Make sure curb boxes do not touch curb cock or main — or, if they must touch, make sure they are insulated from each other.
6. Check cathodically protected services periodically by taking a pipe-to-soil potential reading.

Service Line Renewals

In an effort to reduce costs incurred in digging up old services and replacing them with new lines, many companies in recent years have turned to renewing leaking steel services by using inserts of copper tubing or plastic tubing.

Higher cost of the copper or plastic tubing is offset by reduced expense of digging trenches and replacing lawns. The method is applicable throughout the year and is not affected by having to dig through frozen soil, as experienced by many gas distribution companies in the northern states.

Plastic Insert Renewals. Non-metallic and inert by nature, plastic services and plastic tubing inserted into old steel services require no protection. About the only requirement is that the old steel service—if used as a sleeve—be isolated from the main and from the meter set. This is usually done by cutting away a section of the older steel pipe at each end.

Copper Renewals. Copper services are more corrosion resistant than steel, and because of their slower corrosion rate, the application of protection is not critical.

Unintentional protection is given copper services, however, by the steel or cast iron pipe to which they are connected. If a service is only partially renewed with copper, the remaining steel service line will not have a long life, as the copper-to-steel cell that is established will hasten the corrosion process — which, presumably, made necessary the partial renewal.

For proper protection, all copper used in service renewals should be insulated from both the steel or cast iron main and from the remaining sections of the steel service. Lead gaskets or bushings have proven useful in this respect, being used to seal the ends of the old steel service, which is used as a sleeve. The sleeve, in turn, becomes anodic for any copper exposed to the soil.

As shown in the accompanying illustration, when a partial renewal is made with copper tubing, it is usually necessary to protect the remaining steel section with a sacrificial anode, properly sized.

Acknowledgment

This article adapted from a presentation made by the author to the Operating Section Convention of the Wisconsin Utilities Association. * * *

(Continued from page 29)

a potentiometer that is also equipped for current readings. The box for the switch and the binding post B_1 - B_2 is 6-in. by 2-in. by 2-in.

To operate the switch, the copper sulfate half-cell is connected to proper terminal on the potentiometer. After separating the anode and main lead in the test box, these two wires are attached to B_1 — B_2 (Fig. 1) and the meter switches set to current and voltage scales expected. At this point color coding of leads is not necessary. The outrigger switch is then rotated to right or left and if current meter swings up, the connections are correct.

If the meter swing shows down, then the outrigger switch is rotated in the other direction to the other polarity and readings taken in sequence desired. Should the anode potential be desired, the switch is turned to the other polarity position of PSU, adjust and then read.

While Northern Illinois Gas corrosion engineers lay no claim that this device is the epitome of test meters, they do point out the *Outriggers* have cut testing time in half and increased the number of daily tests. Initial experiences have warranted outfitting potentiometers with the *Outrigger* for use in other company locations. * * *

Dust In Gas Streams

A REPORT ON SUSPENDED PARTICLES IN GAS SYSTEMS

Part 2: Instruments for Collecting and Identifying Particles

Charles B. Moore, John R. Ehrenfeld, and Norman M. Wiederhorn
Arthur D. Little, Inc., Cambridge, Massachusetts

PARTICLES PRESENT IN GAS DISTRIBUTION AND TRANSMISSION SYSTEMS may result in considerable maintenance and service expense. Liquid particles are composed primarily of hydrocarbon oils. They appear as a result of oil fogging, oil losses from compressors and oil bath scrubbers, and from condensation phenomena accompanying pressure reduction. Solid particles present in gas streams usually consist of silica, rust, and gum-like products; the latter have their origin in manufactured gas. Primary origin of the inorganic solid particles would appear to be erosion and corrosion of the lines, construction dirt, and dust that has its source in the well head.

In order to evaluate corrective measures for minimizing the concentration of undesirable suspended particles, it is necessary to have suitable instrumentation for determining particle concentration in the gas stream. A complete analysis of the particulates should provide information concerning the size distribution of the particles and their chemical composition as well as a measure of particle concentration.

Numerous instruments have been employed for characterizing particles in gas streams. They fall into two principal categories — *monitoring instruments* and *particle collection devices*.

Monitoring instrumentation gives a continuous record in time of one or more characteristics of the suspended particles. The monitoring instrument that has been employed to the greatest extent in particle work is the forward angle light scattering instrument. This device measures the intensity of the light scattered by the suspended particles. With suitable calibration, this may be related to the concentration of the particles in gas. Other monitoring instruments of interest are the electrostatic surface area meter, the charged wire impinger, and jet tape collectors. These are but a few of the many instruments that have been employed, with at least some degree of success, for monitoring particles.

Collection devices remove samples of the particles suspended in the gas stream in a form such that they can be examined either with the microscope or by usual chemical and physical techniques. Such instrumentation includes filters, impactors, thermal precipitators, impingers, centrifugal separators, etc. In general, it is possible to obtain more information regarding the suspended particles from collectors of this type than from monitoring equipment. Analysis of the sample, however, often requires considerable skill and time. Nevertheless, the effort expended in obtaining and analyzing such samples results in a larger accumulation of knowledge concerning the suspended matter present in the gas.

When using collection devices, additional adjunct instrumentation is usually necessary. This class of instruments includes the various microscopes and analytical devices for the characterization of the collection. One such device, a differential conductivity meter, sizes and counts solid particulates rapidly and accurately and in many cases promises to eliminate the tedium of microscopic analysis.

Monitoring Instruments

Instruments of this type generally determine some property of particles directly in the gas stream. As a result, the property measured can be considered representative of actual conditions; no alteration of particle properties by the forces necessary for collection need be considered. Monitoring methods are often ambiguous in that the property measured is usually a complex function of particle mass or diameter.

Various light scattering instruments have been employed for the analysis of dust suspended in liquid and gaseous media. The simplest is the *Tyndalometer* or slit ultramicroscope. With this instrument a sample of the fluid is brought within the field of view of a microscope. The sample is illuminated with a light beam that is at right angles to the axis of the microscope, and the light that is scattered is observed through the microscope (Fig. 1). With this instrument each particle is observed as a bright spot on a black background. Therefore, it is possible to determine the number of particles in a given volume of fluid. No information is obtained with regard to the particle size or mass concentration. The instrument is not truly a monitoring instrument as the operator must make a visual observation.

The first truly monitoring instrument based on light scattering was described by LaMer and Sinclair.[1] In this instrument the light, which is scattered by the particles in the direction of propagation of the light beam, is gathered onto a photocell and measured. This is achieved by the use of dark field optics (Fig. 2). The *forward-angle light-scattering photometer* described by LaMer and Sinclair has been modified to make it adaptable for use with gases at pressures of 2000 psi and less. This work was done at Arthur D. Little, Inc. under sponsorship of the American Gas Association on PAR projects PF-15 and NFX-12.[2] The *A.G.A. light-scattering photometer* gives a continuous record of the light scattered by material suspended in the gas stream. This, in turn, may be correlated with the concentration of the suspended particles. It does not give direct information concerning the size of the particles.

Light-scattering instruments have been described by Gucker and others,[3,4] that count and size the particles automatically. In these instruments, the aerosol is passed through a sharply defined illuminated region in such a manner that light pulses from individual particles are recorded. To reduce the coincidence of counts, very dilute aerosols must be used.

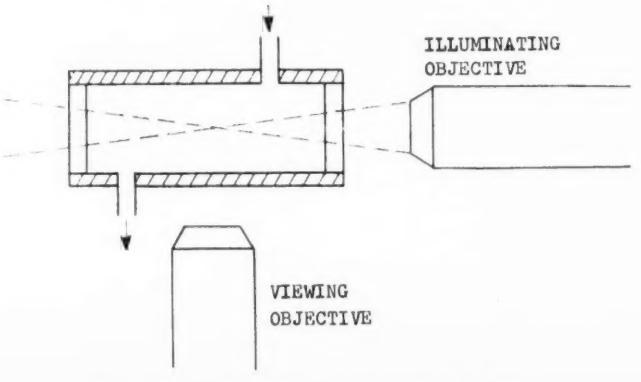


Fig. 1. Diagram shows operation of Tyndalometer.

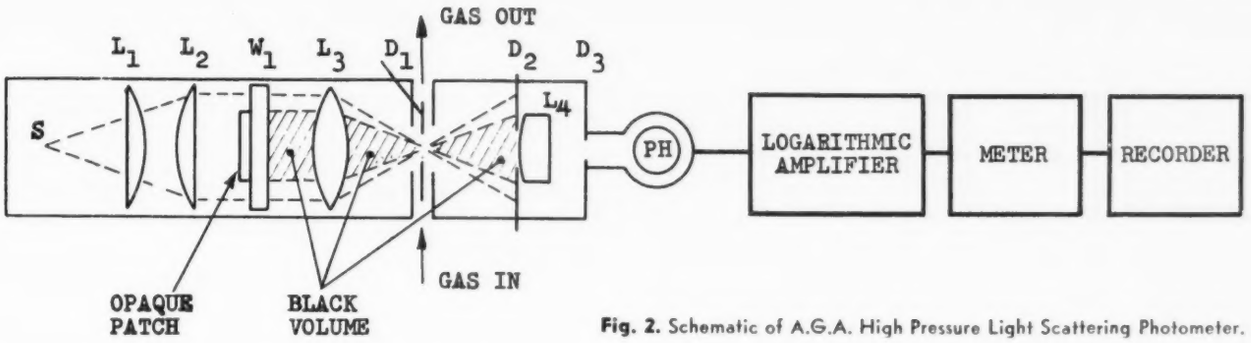


Fig. 2. Schematic of A.G.A. High Pressure Light Scattering Photometer.

Dilution of high concentration aerosols is therefore necessary. This is a serious disadvantage when dealing with volatile droplets. For particles of similar refractive index, the amplitude of the light pulse can be related to the size of the particles. Particles as small as 0.5 microns can be counted.

Methods based on light transmission have been used for monitoring purposes and commercial instruments based on this principle are available.[5] Generally, the aerosol concentrations are so low that excessively long optical paths are necessary for adequate sensitivity. An interesting variation on light transmission methods is the condensation nuclei apparatus in which water vapor is condensed on submicroscopic particles.[6] The resulting water droplets are uniform in particle size and the light transmission through them is then directly related to the number of particles in the gas. This is useful only for submicron particles.

An *electrostatic particle counter* has been described by Guyton.[7] The instrument consists of a wire placed in the gas stream. Particles impinging on this wire produce an electric impulse that is amplified and recorded. Particle populations may be determined by this device. In addition an empirical relationship exists between particle diameter and the amplitude of the electrical impulse. Thus, particle size distributions can be obtained. The device is not satisfactory for submicron particles.

With the *electrostatic surface area meter*[8] the particles in a gas stream are charged by passing through a corona discharge. The total charge accepted by the particles is measured by passing the charged cloud through an insulated section of pipe. The potential developed in this section is proportional to the total charge on the particles. This, in turn, is proportional to the surface area of the particle for spherical particles. Unfortunately, the charging mechanism is complex for particles less than about one micron in diameter and the one to one interrelation of surface area and charge disappears.

More serious, however, is the fact that with nonspherical particles having sharp edges, the charge that is accepted by the particle may be appreciably less than would be anticipated on the basis of the surface area of the particle. This is due to the fact that the charge leaks off sharp edges and points. The magnitude of such errors has not been evaluated, but it may be expected to be considerable.

An instrument of considerable interest for sampling liquid particles is the *hot wire evaporator*.[9] A wire is suspended in the gas stream and maintained at temperature by an electric current passing through it. Liquid particles striking the wire evaporate. This in turn cools the wire, causing a change in the resistance. If the wire is maintained at a sufficiently high temperature, the evaporation will be rapid and the change in resistance can be observed as a pulse. From the size of the pulse, information can be gleaned concerning the particle size. Principal disadvantage of this instrument is that it is also a hot wire anemometer of extreme sensitivity. Consequently, the linear velocity of the gas past the wire must be maintained constant. Turbulent flow cannot be tolerated, since eddies will be recorded as particles.

These are but some of the continuous recording instruments that have been developed. In practice, none have found widespread usage. The forward angle light scattering instrument has been employed most extensively and has been more thoroughly investigated than the others. Only a few gas companies have had experience with such equipment to date.

Particle Collection Devices

A large number of particle collection devices have been described and used. The characteristic feature of such devices is that a sample of the gas is brought to the collector, which separates the suspended particles from the gas stream. In this manner the particles are concentrated to a sufficient extent so that they may be examined. Examination of the collection falls into three principal categories.

1. It simply may be weighed. If this is done and the volume of gas from which the particles were removed is known, then the mass concentration of suspended matter is determined.

2. The collection may be subjected to chemical analysis to determine the chemical constitution of the material that is carried in the gas stream. Various analytical procedures have been employed for this purpose ranging from simple qualitative to complex and exhaustive quantitative procedures.

3. Particle collections may be examined to determine the number of particles in the gas stream, and the size and size distribution of these particles. Generally, when information of this type is required, the particles must be collected and observed as individual entities. There are collection devices, however, that have been constructed that classify the particles according to size.

Collection devices discussed in the following paragraphs are those that have been employed most extensively or have particular features of greatest interest. They are but a few of the many instruments that have been described.

Filters are the most common and generally the most useful collection devices. Two general types of filter media have been used, namely, *filter mats* such as papers, felts, etc. and *porous membranes*, such as the Millipore filter.

The filter mats are normally employed when it is desired to collect samples for gravimetric or chemical analysis or both. The particles are collected throughout the depth of the mat and consequently cannot be examined individually for a particle size analysis. Specific papers for work of this nature have been prepared; most noteworthy is the "Absolute" filter paper.[10] This material is characterized by a low-pressure drop through the filter and by a collection efficiency greater than 99.9% for particles as small as 0.3 microns (Fig. 3). Furthermore, it is an all-glass filter media and consequently the collection can be subjected to most common analytical procedures.

The *membrane-type filter* medium collects the particles on the surface of the membrane.[11] Consequently, the collection is on an essentially flat plane. This facilitates micro-

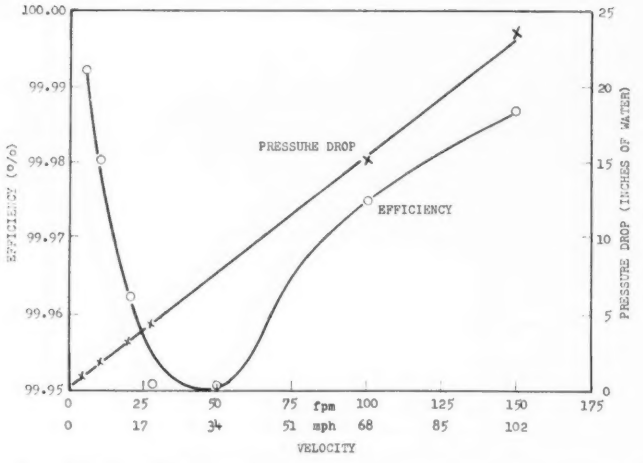


Fig. 3. Collection efficiency and low-pressure drop characteristics of Absolute Filter Paper are shown in above curves for 0.3 micron particle penetration and pressure drop plotted against velocity.

Fig. 4. Filter holder for both membrane-type filters and filter mats.

scopic examination of the particles. Unfortunately, the currently available membranes are wet by the liquid particles commonly found in gas systems. Consequently, such particles spread out on and are absorbed in the collection media. Therefore, they cannot be examined. Thus, filters of this type are suitable only for the examination of solid particles.

Membrane filters may be used for gravimetric analyses, but their capacity is limited and the pressure drop across them is very much greater than with "Absolute" filter papers. The latter, therefore, are to be preferred for this type of collection. A picture of a filter holder that may be used for both types of collection media is shown in Fig. 4.

A number of commercially available *sedimentation instruments* utilize the principle of sedimentation for characterizing the size, number, and weight of particles. In such instruments a sample is brought into a chamber that is maintained at constant temperature. The particles are permitted to settle through the chamber and are collected at the bottom. In general such instruments are suitable only when the particle concentration is extremely high or for particles of high density. Otherwise the time of settling becomes so long as to be impracticable. Wall losses and particle agglomeration also become appreciable over long periods of time.

A large number of instruments based on the principle of *impingement* are available. Among the earliest instruments developed were the *one stage impactors* such as the *Konimeters*, the *Owens-Jet Dust* [12] and the *Bausch and Lomb Dust Counter*.[13]

In the last two instruments, air is sucked by means of a hand pump into a mist chamber before being passed through a slit where it impinges against a collection plate. Condensation of moisture due to expansion downstream of the slit assists in the deposition. Analysis of the sample is by microscope. The instruments, although simple, are not highly efficient.

Impactors generally operate as grab samplers in that the collected sample represents the aerosol picture over the small length of time required to collect the sample only. By slowly moving a collection tape past a stationary jet the sample may be integrated over extended periods of time. When it is possible to analyze the collected sample continuously the instrument operates as a monitoring device. Optical

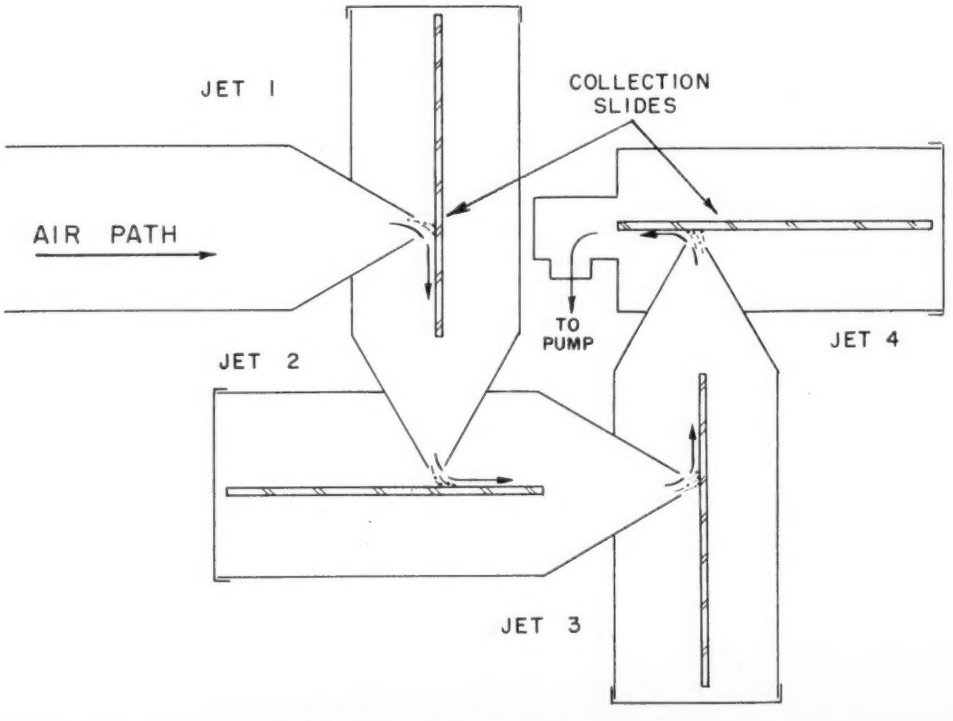


Fig. 5. Schematic of Cascade Impactor.

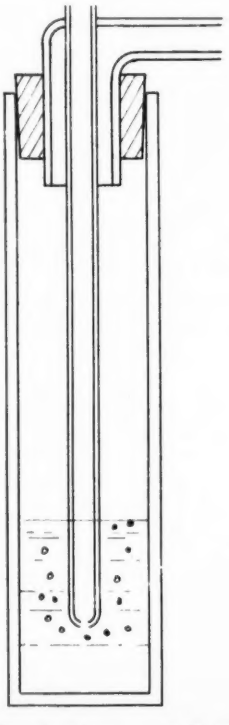


Fig. 6. Diagram of Smith-Greenburg Impinger.

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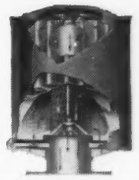
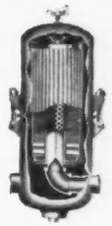
Write for Bulletin 200 which contains complete engineering data and illustrated material on Staynew Pipe Line Filters. Dollinger Corporation, Dept. 99, Centre Park, Rochester 3, N.Y.



INTAKE FILTERS

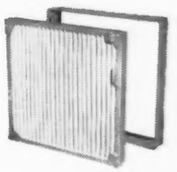


LIQUID FILTERS

PIPE LINE FILTERS

ELECTRO-STAYNEW PRECIPITATOR

AUTOMATIC AIR FILTERS



PANEL FILTERS

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STAYNEW **DOLLINGER**

FILTERS

LIQUID FILTERS • PIPE LINE FILTERS • INTAKE FILTERS • HYDRAULIC FILTERS • ELECTROSTATIC FILTERS • MIST COLLECTORS • DRY PANEL FILTERS • SPECIAL DESIGN FILTERS • VISCOUS PANEL FILTERS • LOW PRESSURE FILTERS HIGH PRESSURE FILTERS • AUTOMATIC VENTILATION FILTERS • NATURAL GAS FILTERS • SILENCER FILTERS

methods of analysis have been used with such instruments.

In the *cascade impactor*[14] the gas stream is caused by flow through a series of jets in series (Fig. 5). The velocity of the gas increases in each stage and consequently smaller particles are impacted out on the collection plate at successive stages. Thus a classification according to particle size is achieved. The cascade impactor should not be used for the collection of liquid particles, since condensation occurs on the expansion and cooling of the gas downstream of the jet. Furthermore, liquid particles may be shattered on impact against the collector plate. The unit is very useful for the collection of solid particles and with suitable design can collect particles as small as 0.1 microns.

Impingers are another group of instruments in which impaction takes place on a surface. In this case, however, the collecting surface is immersed in a liquid medium and the particles are obtained as a suspension in the liquid. The *Smith-Greenburg impinger*[15] (Fig. 6) is probably the most commonly used instrument of this type, although its usefulness for particles smaller than about two microns is questionable.

Cyclone Separators are used to collect and classify particles. In general these devices are useful for large particles and for large collections since analysis is by weight. The minimum particle size that can be collected efficiently is about two to three microns. A related instrument called the *conifuge*[16] is essentially a conical centrifuge that deposits the particles in a spectrum according to their settling velocities. The graded nature of the sample obtained with this instrument simplifies the normal method for deriving the size distribution curve by sizing and counting under the microscope. Because of this, the instrument is of considerable interest. The instrument samples at the rate of only 25 cc per minute however, and collects a sample over a large area rather than concentrating it, as is the case with the conventional impactors. Consequently, long time periods are required to collect suitable samples for examination. For this reason the instrument is not normally used for gas sampling work.

An interesting instrument, similar in principle to the conifuge, but much simplier in design has been described by A. G. Setterling.[17] In this instrument (Fig. 7), the gas is pulled through a rectangular spiral passage that continually decreases in width. Consequently, the gas continually increases in linear velocity with a corresponding increase in the centrifugal force on each particle. Thus the larger particles are deposited at the beginning of the passage and the smaller at the end. The collection medium in this instrument is a tape along the outside wall of the spiral. This tape readily slips in and out of the instrument.

A number of *electrostatic precipitators* have been developed for the collection of aerosol samples by electrostatic precipitation. These instruments operate by charging the particles in the gas stream and then passing the gas through an electric field. The particles migrate to and are collected on the electrode whose polarity is opposite to the charge that they carry. Although equipment of this type has found large scale application in industrial air cleaning installations, the available commercial sampling instruments collect the sample over a large area. As a result these collectors are not suitable for sampling the low concentration aerosols normally found in gas systems. A recent development,[18] however, involves precipitation of the particles on to the weighing pan of a sensitive microbalance. As yet this instrument is not available commercially.

Instruments for Analysis

In recent years a variety of microchemical and microscopic techniques have been developed for analysis of particulates. Outstanding among these developments have been the use of the *electron microscope* and *phase contrast microscopy*. *Automatic scanning of a particle collection* field is also a major development.[19] The problem is a difficult one and much remains to be done along these lines.

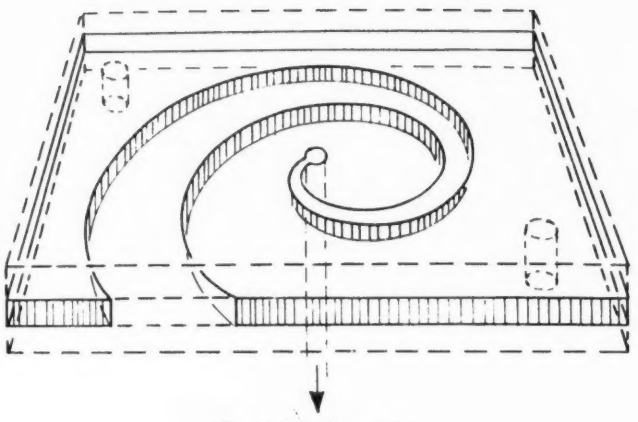

Fig. 7. Spiral sampler.

A *differential conductivity counter* has recently been developed for counting and sizing particles suspended in a conductive liquid media.[20] It is based on an entirely new concept analysis and in many instances eliminates the need for tedious, time consuming microscopic counts.

A suspension of particles in a conductive liquid is passed through an aperture through which an electric current is flowing. When a particle is in the aperture the resistance of the circuit increases in proportion to the volume of the particle. Thus, each time a particle passes through the aperture there is a negative pulse in the conductivity of the suspension. The size of the pulse is a direct function of the particle size. The instrument counts the pulses and their magnitude. It is sensitive for particles ranging from about 0.5 to 200 microns in diameter and is extremely fast.

The instrument is readily amenable for use with a collector such as the impinger. By proper choice of conductive media a series of size analysis could be taken which would separate different chemically particulate constituents. The possibilities at the present time are extremely attractive. Agglomeration of the particles in the collector would probably be a main source or error. Fortunately, in most cases the signal response will be independent of the electrical properties of the particle.

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Part 3 will appear in the next issue.

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Hi-Btu Gases from Fluid Fuels

Present and Future Methods

Part 3 — Cyclic Regenerative Hydrogasification and Cyclic Reforming

Henry R. Linden, *Research Director, and* **Martin A. Elliott,** *Director, Institute of Gas Technology, Chicago, Illinois*

Cyclic-Regenerative Hydrogasification

Production of high-Btu gas in the presence of a hydrogen-rich carrier gas has been successfully accomplished in a four-shell cyclic-regenerative pilot unit (Fig. 5). This unit has a nominal make oil capacity of 50 gal per hour, and has been operated with a variety of distillate and residual oils at make pressures up to 50 psig. Hydrogen was supplied from an external source in quantities up to 65 Scf per gal of make oil.

The use of carrier hydrogen permits the production, from all types of oil, of low specific gravity gases having excellent natural gas substitutability characteristics (Table 11). Furthermore, at near-atmospheric pressure, set capacities are increased by 20 percent for low-grade residual oils, and by more than 40 percent for premium oils. At higher pressures (30 to 50 psig maximum make pressure), set capacities were not increased substantially by the use of hydrogen, but the gas produced was almost 100 percent substitutable for natural gas. Operation at high pressure with residual oils is not recommended because of reduction in Btu recovery and excessive coke laydown.

Economics of increasing plant capacity by use of a hydrogen-rich carrier gas depend on the cost of installing and operating hydrogen production facilities in comparison with the cost of increasing oil storage and handling, generator, and tar-handling facilities to obtain the same capacity

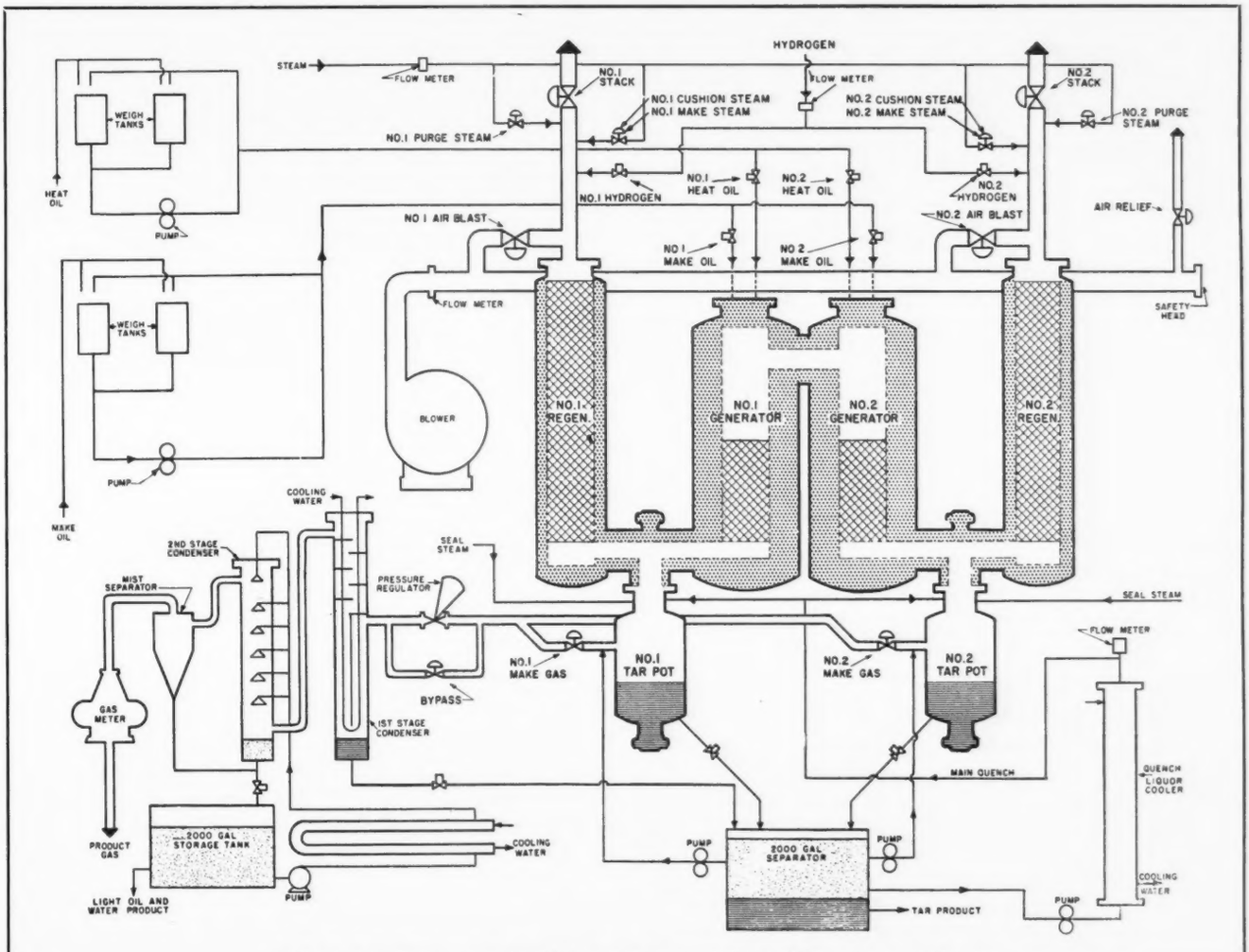


FIG. 5. Flow diagram of four-shell cyclic regenerative high-Btu oil gas pilot unit.

TABLE 11. Gasification Results for Four-Shell Cyclic-Regenerative High-Btu Oil Gas Pilot Unit.

Run No.	7	38	39	16	18	32-C	40	33	37	35-A	35-B
Oil											
Type	No. 2 Fuel Oil			Reduced Crude Oil				No. 6 Fuel Oil			
°API	36.3-36.4			21.8-23.2				11.0-13.0			
Carbon/Hydrogen Weight Ratio	6.65-6.67			6.99-7.08				.832-8.57			
Conradson Carbon Residue, wt %	0			5.3-6.6				11.4-12.9			
Process Feeds*											
Make Oil, gal/hr	54.00	77.42	78.35	50.09	46.81	43.90	51.31	49.86	49.42	48.31	41.68
Process Hydrogen, SCF/gal†	0.0	47.5	40.9	0.0	59.9	54.5	54.0	0.0	52.0	56.3	66.1
Heat Oil, gal/hr	10.53	12.55	9.62	8.55	8.52	1.79	8.02	6.06	5.75	4.92	0.0
Blast Air, SCF/hr	34560	29670	25180	26980	26300	26870	33200	28820	32310	26060	26360
Make Steam Feed, lb/hr	233	270	259	395	283	194	210	213	219	232	212
Operating Conditions											
Temperature, °F											
Average Generator	1657	1659	1571	1530	1490	1391	1551	1575	1539	1504	1406
No. 1 Regenerator, top	457	230	226	373	338	283	200	237	224	308	292
bottom	1835	1603	1531	1447	1453	1458	1349	1482	1355	1458	1323
No. 2 Regenerator, top	388	348	278	360	—	309	241	299	303	297	288
bottom	1772	1598	1481	1364	1348	1336	1333	1378	1388	1348	1427
Maximum Make Pressure, psig	7.0	9.0	29.5	6.0	7.0	40.0	9.0	5.0	6.7	15.5	39.5
Operating Results											
Product Distribution, wt%											
Gas	48.16	60.26	56.62	55.04	75.80	51.86	60.63	38.97	41.91	39.61	30.68
Liquid Products**	46.02	39.74	40.73	41.04	23.44	30.25	34.30	55.27	51.50	51.61	50.26
Coke††	5.82	0.0	2.65	3.92	0.76	17.89	5.07	5.76	6.59	8.78	19.06
Make Gas, SCF/hr	3984	8385	7432	4336	6268	4040	5450	3534	4535	4395	3147
Btu Recovery, Net, MBtu/gal	79.08	93.43	85.19	95.15	123.17	81.61	99.06	74.49	73.05	67.73	48.91
Btu Recovery, Gross, MBtu/gal	79.08	107.91	97.81	95.15	144.89	98.07	116.05	74.49	89.12	84.73	69.02
Feed Consumption											
Make Oil, gal/MMBtu, gross	12.65	9.27	10.22	10.51	6.90	10.20	8.62	13.42	11.22	11.80	14.49
gal/MMBtu, net	12.65	10.70	11.74	10.51	8.12	12.25	10.10	13.42	13.69	14.76	20.44
Heat Oil, gal/MMBtu, gross	2.47	1.50	1.26	1.79	1.26	0.41	1.35	1.63	1.30	1.20	0.0
gal/MMBtu, net	2.47	1.70	1.44	1.79	1.48	0.50	1.58	1.63	1.59	1.50	0.0
Hydrogen (H_2) Reacted, SCF/gal	—	16.4	10.1	—	8.4	20.1	15.5	—	11.4	17.4	30.0
Make Gas Properties											
Composition, mole %											
Hydrogen	23.3	34.3	29.9	20.2	29.5	31.0	33.5	21.7	40.8	38.2	37.7
Methane	43.3	29.0	36.0	36.9	29.2	35.3	22.2	35.8	20.8	27.8	33.2
Ethane	2.8	2.5	3.7	2.8	4.3	5.3	3.5	2.6	2.8	3.4	4.5
Propane and Higher Paraffins	0.1	0.0	0.1	0.1	0.1	0.3	0.3	0.1	0.5	0.1	0.4
Ethylene	18.0	22.7	17.2	22.3	20.1	12.9	20.0	20.7	16.3	16.4	11.5
Propylene	5.0	3.0	3.0	3.4	4.8	4.0	7.3	3.0	6.2	4.1	3.2
Butylenes and Higher Olefins	0.3	0.1	0.0	0.2	1.1	0.5	1.2	0.1	0.5	0.4	0.5
Acetylene and Diolefins	1.5	1.7	0.8	1.3	1.9	0.6	2.5	1.3	2.1	1.3	0.9
Benzene	1.4	1.8	2.9	2.7	1.7	3.3	1.7	2.3	1.5	1.3	1.5
Toluene and Higher Aromatics	0.2	0.2	0.7	0.9	0.8	1.1	0.4	0.7	0.7	0.4	0.4
Carbon Monoxide	1.3	1.0	1.9	0.2	0.0	3.1	4.5	7.0	0.5	0.0	0.1
Carbon Dioxide	1.8	1.0	1.1	1.2	1.6	1.6	0.8	1.1	1.8	2.2	1.7
Nitrogen	1.0	2.7	2.7	7.8	4.9	1.0	2.1	3.6	5.5	4.4	4.4
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Heating Value, Btu/SCF	1072	996	1031	1099	1082	1066	1093	1051	971	931	914
Specific Gravity, Air=1	0.659	0.611	0.648	0.741	0.696	0.673	0.696	0.717	0.630	0.593	0.573

*Length of total cycle 465-484 seconds (232-242 seconds in each direction) including 34-39% make oil and hydrogen introduction, 9-17% make purge (steam only) and depressurization, 39-48% blast and 9-10% blast purge.
†80.0-95.2 mol % purity.
**By difference.
††Calculated from difference in carbon content of flue gas (CO plus CO_2) and carbon content of heat oil assuming 6 wt % hydrogen content of deposited coke.

increase. To eliminate external hydrogen production facilities, current development work on this process is directed toward the production of hydrogen-rich carrier gas by cyclic catalytic reforming of low molecular weight hydrocarbons within the set itself.

The pilot unit incorporates several improvements in design, including the use of clean regenerators instead of conventional superheaters, elimination of hot valves, and substitution of a dual, closed circulation product quench system for the water-sealed wash box. These improvements reduced coke and pitch deposition problems, by-product handling difficulties, and smoke formation, and resulted in the production of lower inert content high-Btu gases than are obtainable from conventional sets.

Cyclic Reforming Processes

During the past few years, four cyclic processes originally designed for the production of low heating value gas have been considered for the production of natural gas supplements. These are the Koppers-Hasche, the United Gas Improvement Company cyclic catalytic reforming, the Segas, and the ONIA-GEGI processes.

The **Koppers-Hasche process** is a regenerative partial combustion process of high thermal efficiency, in which a mixture of hydrocarbon gas or vapor and air is fed in sequence through the regenerator, a combustion chamber, and a second regenerator. The flow is reversed after suitable intervals to maintain minimum discharge temperatures. At present, the Koppers-Hasche process is primarily used for partial-combustion reforming of propane to 500 to 700 Btu/Scf gases of high specific-gravity, which are used to supplement or replace gases produced by less economical manufacturing processes (Table 12). In this application it

TABLE 12. Partial Combustion of Propane in a Koppers-Hasche Reformer.

Make Gas Heating Value, Btu/cu ft	590	680	785	890	991	1091
Make Gas Composition, vol %						
CO_2	2.1	2.0	1.4	1.0	0.7	0.7
C_2H_2	0.7	0.3	0.2	0.2	0.2	0.2
C_3+	2.2	4.0	6.1	7.4	7.6	7.5
C_2H_4	12.8	12.9	12.6	12.1	11.5	10.7
O_2	1.8	1.7	1.7	1.7	1.7	1.7
CO	6.0	5.0	4.4	3.9	3.6	3.3
H_2	8.7	7.1	6.4	5.9	5.5	5.2
CH_4	12.3	12.5	12.2	11.7	11.0	10.2
C_3H_8	5.9	8.2	11.0	14.5	19.2	24.2
N_2	47.5	46.3	44.0	41.6	39.0	36.3
Make Gas Specific Gravity, Air=1	0.89	0.93	0.97	1.01	1.04	1.07
Air/Propane Feed Ratio	2.3	1.9	1.6	1.4	1.2	1.1
Average Combustion Zone Temperature,°F	1550	1490	1430	1370	1310	1250
Cold Gas Efficiency, %	92	93	94	95	96	96.7

has the advantage of low labor and investment costs, but the disadvantage of high fuel storage costs. Operating difficulties with impurities in the product gas have also been encountered.

When the partial combustion cycle is used to produce 1000 Btu/Scf gases, the high nitrogen content and the large percentage of unconverted propane and other C_3-plus hydrocarbons results in specific gravities of over one (Table 12) and, consequently, low burner heat inputs.

After cold enrichment with propane to about 1200 Btu/Scf, the substitutability for natural gas has been found to be higher than that of propane-air gases of equal heating value. Low specific gravity high-Btu gases have been produced in a pilot plant by thermal reforming of natural gas liquids, in the presence of various amounts of steam, with a conventional heat-making cycle similar to that used in the cyclic high-Btu oil gas process. Compositions of these gases are similar to those shown in Table 7.

In 1955, factory costs of Koppers-Hasche units of 1 to 2.5 MMcf per day capacity of 515 to 750 Btu/Scf gas were reported by Frink to range from $23,000 to $38,000. Rogers reports a 1956 installed cost of $90,000 for a 5 MMcf per day high-Btu unit operating on a propane partial combustion cycle. This cost does not include connecting piping and wiring, housing, land and land improvements.

The **United Gas Improvement Company cyclic catalytic reforming (CCR) process** was developed to convert carbureted water gas sets to the production of carrier gas by placing in the former superheater a bed of nickel catalyst on a refractory support, and by using the carbureter as a combustion chamber and process steam superheater.

In this process, natural gas or other hydrocarbon fuels are burned in the combustion chamber to heat the refactories and the catalyst bed, and to remove deposited carbon and sulfur compounds from the catalyst. Heat from the blast gas is recovered in a waste-heat boiler. In the subsequent make period, steam is superheated by checkerbrick at the bottom of the combustion chamber, and the process hydrocarbon is introduced into the bottom connection between the combustion chamber and the catalyst chamber.

Although this process was originally developed for use with natural gas and LPG to produce low heating value, low specific gravity, carrier gases suitable for re-enrichment with natural gas or propane, in the past several years it has been used with hydrocarbon feeds of increasing molecular weight, and is now being considered for high-Btu gas production at reduced operating temperatures.

In pilot plant tests (Table 13) in which approximately 10,000 gal of residual oil were used, the CCR process operated satisfactorily in the production of high heating value gases. Conversions to gas were significantly greater than in conventional thermal cracking processes. Product gases contained high concentrations of carbon monoxide and illuminants, however, and low concentrations of methane. The special nickel catalyst developed for heavy oil operation apparently maintains activity, at least in the first part of each make cycle, in spite of the very severe operating conditions.

In more recent tests with a full-scale CCR unit (Table 13), 600,000 gal of Bunker "C" fuel oil were used to produce 58,500 Mcf of catalytic oil gas. Set capacity was 4000 to 4400 MMBtu per day, and the Btu recovery was 94 MBtu per gal, compared to an estimated equivalent recovery in conventional high-Btu oil gas operation of 75 to 80 MBtu per gal. The combustion performance of the 1069 Btu/Scf, 0.78 specific gravity catalytic oil gas on appliances adjusted to 1030 Btu/Scf, 0.62 specific gravity, natural gas, was reported to be acceptable. Tar properties were also satisfactory.

The **Segas process** was developed by the South Eastern Gas Board in Great Britain, and is similar to the CCR process and the French **ONIA-GEGI process** except that it uses lime-bauxite or lime-magnesite catalysts instead of supported metal catalysts. The Segas process also uses only regenerative heat recovery in the commercial designs described in the literature. Further, in the Segas and ONIA-GEGI processes, the reactants flow downward through the catalyst bed, whereas in the CCR process the flow is upward. The most recent designs of all of the three cyclic catalytic cracking processes employ the principle of process hydrocarbon introduction into superheated steam at a point where no direct contact of feed hydrocarbon and catalyst bed is possible.

When a carbureted water gas set is converted to the Segas process, the blue-gas generator becomes the steam preheater, the carburetor becomes the catalyst chamber, and the superheater becomes the air preheater. During the make period, steam is superheated in the first vessel, oil is introduced at the top of the first and second vessels, and the cracked products are regenerated in the air preheater and then pass through the washbox. The blast is in the reverse direction. Deposited carbon is burned off, and additional fuel is introduced in the bottom of the air preheater. The Segas and ONIA-GEGI processes appear to be capable of producing high-Btu gases with operating results similar to those of the CCR process.

Part 4 will appear next month.

TABLE 13. Typical Results from Heavy Oil Operation with the CCR Process.

2 ft O.D. Pilot Plant Operation

Oil Properties	18° API, 1.41 wt % Sulphur, 7.09 wt % Conradson Carbon Residue		
Heating Value of Oil Gas (Calorimeter)	825	906	1032
Specific Gravity of Oil Gas (Ranarex)	0.73	0.72	0.80
Oil for Process, gal/Mcf	8.27	9.79	11.11
Thermal Yield, % (oil to gas)	66.6	65.0	62.2
Gas Analysis, vol %			
Carbon Dioxide	7.8	6.4	6.2
Illuminants	22.2	26.4	35.6
Oxygen	1.0	0.8	1.0
Carbon Monoxide	15.0	12.6	8.6
Methane	18.2	21.0	22.9
Hydrogen	30.0	26.7	19.3
Nitrogen	5.8	6.1	6.4

2 ft O.D. Pilot Plant Operation

Oil Properties	12.7° API, 2.45 wt % Sulphur, 11.3 wt % Conradson Carbon Residue		
Heating Value of Oil Gas (Calorimeter)	750	805	1000
Specific Gravity of Oil Gas (Ranarex)	0.635	0.695	0.81
Oil for Process, gal/ Mcf	7.05	7.62	9.92
Thermal Yield, % (oil to gas)	67.9	70.6	68.0
Gas Analysis, vol %			
Carbon Dioxide	6.0	6.4	5.0
Illuminants	15.4	20.0	30.0
Oxygen	0.8	0.8	0.8
Carbon Monoxide	17.0	15.0	10.8
Methane	21.6	22.7	23.0
Hydrogen	33.8	28.7	22.4
Nitrogen	5.4	6.0	8.0

12 ft O.D. 2-Shell Plant Operation

Oil Properties	14.4° API, 2.0 wt % Sulphur, 10.5 wt % Conradson Carbon Residue		
Heating Value of Oil Gas (Calorimeter)	783	890	1069
Specific Gravity of Oil Gas (Ranarex)	0.65	0.73	0.78
Oil for Process, gal/Mcf	10.65	(1000 Btu basis)	
Thermal Yield, % (oil to gas)		64	
Gas Analysis, vol %			
Carbon Dioxide	3.3	3.2	3.0
Illuminants	18.3	23.0	30.8
Oxygen	1.1	1.8	0.7
Carbon Monoxide	9.3	7.3	5.6
Methane	24.9	26.5	25.6
Ethane	0.1	0.9	2.6
Hydrogen	29.6	26.2	20.3
Nitrogen	8.9	11.1	11.4

Small tractor with boom is used to lower line into trench alongside busy main street. Note trench lies between street and sidewalk — and in background dodges around ancient trees.

Hot wrapping a joint of the 8-in. line shortly after welding helps speed construction.

RG&E Finds Good Public Relations Big Help When Laying Mains in Congested Areas

Martin H. Oogjen, *Engineering Department, Rochester Gas and Electric Corporation, Rochester, New York*

WELL PLANNED "PUBLIC RELATIONS" contributed materially to the rapid construction of nearly 14 miles of 8-in. gas line by Rochester Gas and Electric Company to serve an area between Webster and East Williamson — in upper New York State along route 104 east of Rochester — with natural gas.

Success of the construction venture is attributed to many related and coordinated efforts by RG&E's departments, including:

1. Orientation of residents,
2. Fast and efficient work by contractors,
3. Constant supervision by RG&E's engineering department.

While the wheels of management were busily engaged in obtaining the necessary franchise for serving gas in the area to be supplied by the new gas line, plans and specifications for the work were being developed by the engineering department.

There was much to be done in both fields of endeavor. Obtaining the franchise entailed many meetings with town and village boards culminating in a final petition to the New York Public Service Commission, which granted the franchise.

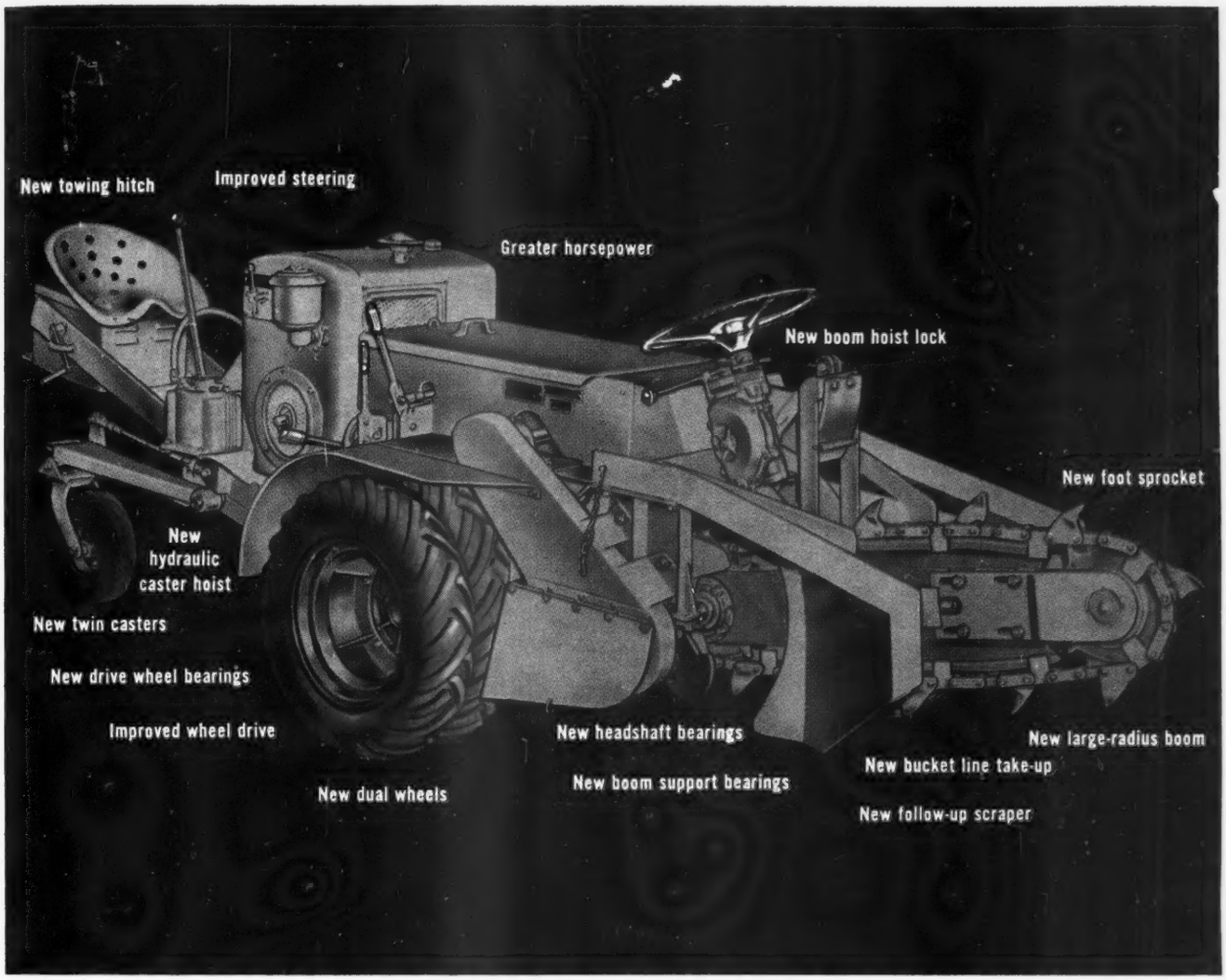
Work by RG&E's engineering department included foot-by-foot inspection and mapping of the proposed route, and the matter of obtaining construction permits from various local agencies — such as State Highway Departments in both Monroe and Wayne counties; County and Village highway authorities in both Monroe and Wayne counties, and permits for crossing the New York Central Railroad at two points. In all, 13 separate permits were obtained from seven different and unrelated agencies.

All of the foregoing was accomplished, along with the usual inspection of the site by the competing bidders and awards to success contractors prior to actual construction, which began six days after the franchise was granted. Concurrently, pipe was shipped from the mill to previously arranged storage sites reasonably close to the job. The job had been let in three different sections, and the company was fortunate in obtaining storage facilities adjacent to the railroad.

Construction was complicated at many points due to the location of innumerable old and large shade trees at the edge of the highway line on both sides of the highway. This resulted in having to do considerable tunneling, which slowed progress. This problem became even more difficult within village limits, where the trees were between the edge of the pavement and sidewalk, with the highway line located within the sidewalk.

There were also many other problems in going through the main streets

In less congested area, rubber-tire mounted crane is used on lowering-in operations.



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The 300% more brake area and improved lever action make steering easier, more accurate. Optional follow-up scraper assures clean trench. New bucket line take-up is readily accessible.

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of the small villages enroute. It became a feat of no small complexity to dig trench in front of innumerable fruit stands, stores, and other establishments while simultaneously permitting business to "go on" as usual. All of this was successfully accomplished.

Two important factors with respect to public relations were the initial contact with abutting property owners on both sides of the road, and cleanup along the job as the work progressed as well as after construction work was finished.

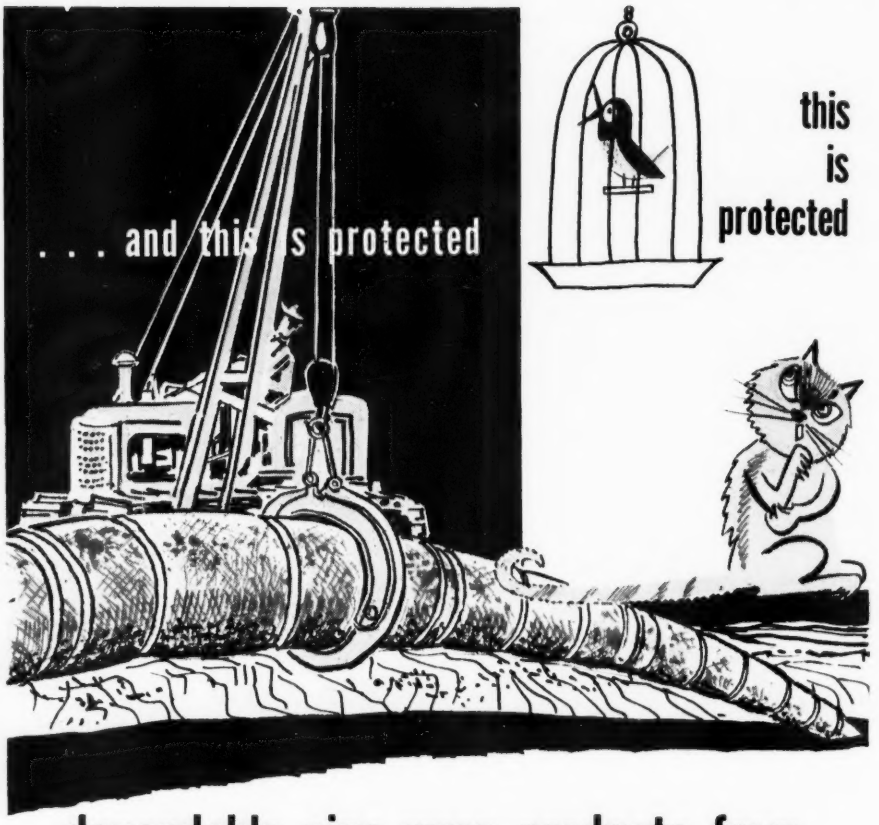
Original contact was made by the sales promotion department during a survey of the potential of the area, made prior to the consummation of franchise negotiations. Second contact with these people was made by the superintendent of construction, prior to construction operations, to properly inform them of what was going on, and to make construction timing and arrangements to cause the least inconvenience to the affected property owners. While the new mains were installed entirely within the public right-of-way, it was imperative that access to the adjoining property be maintained at all times.

Considerable interest was shown by prospective customers along the route of this new line. They had been told of the tests that would be applied to the line before it was filled with gas. Prospective and interested customers watched the radiographic inspection of the welded joints and the hydrostatic tests, the latter made at 650 psi in addition to a 120 psi air test.

It was evident that customers and prospective customers were pleased when the job was completed and gas was turned on in the first customer's house one day before it had been promised.

With respect to the final cleanup, the contract for installing the pipe included specifications requiring adequate safeguards be provided at all times during construction. Within 24 hours after pipe was buried, the area around and over the ditch was fine graded and seeded, restoring it to a condition as good — and sometimes better than – existed before construction began. Under the contract, it was the obligation of the contractor to do this work to the satisfaction of the RG&E's superintendent of construction. The contractors gave very satisfactory performance in this respect, as evidenced by both property owners and company inspectors.

Installation of the 8-in. gas line and other mains and services was equally divided among the three contractors—Keegan Utilities Contractors, Wm. A. Curtis Corporation, and Consolidated Gas and Service Corporation. * * *



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DISTRIBUTION DEVELOPMENTS

NEWS ABOUT CURRENT AND PLANNED CONSTRUCTION

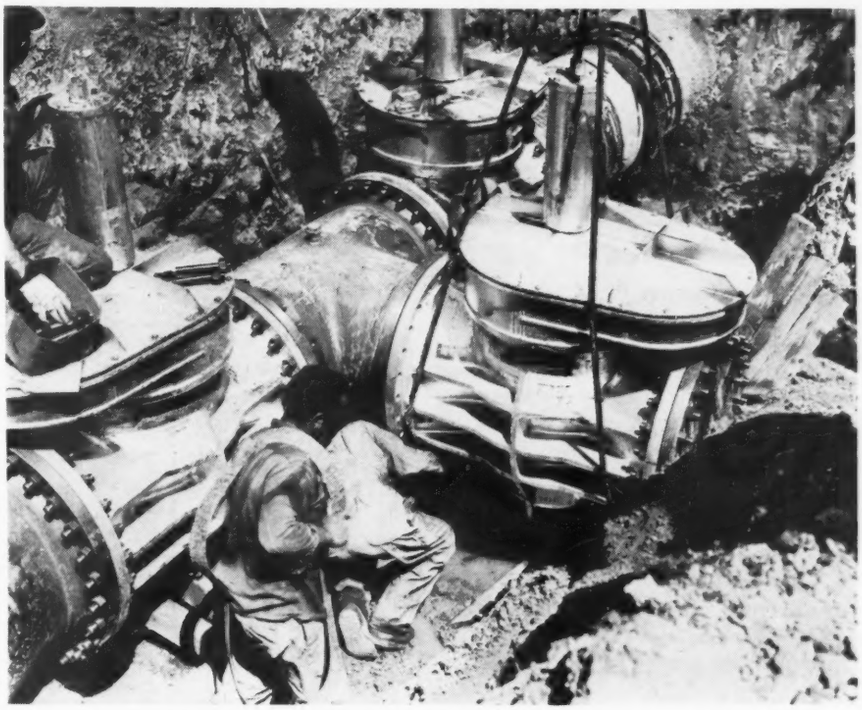
Arizona Public Service Company, Phoenix, Arizona, has completed a new 500-customer gas distribution system at Gila Bend using plastic pipe for the first time in a portion of the main system. Previously, APS used plastic pipe only for service lines. Company crews built the distribution system and Alex Robertson was contractor, on the feeder line. Use of plastic pipe in the new system is expected to save approximately 20 to 30 percent in labor and material. Another recently completed project was relocation of approximately 3000 ft of 50 psi "belt line" in Globe, Arizona, to accommodate a truck by-pass highway widening project. Preliminary year-end reports show nearly 7766 new customers were added to APS system in 1958 and nearly 200 miles of gas line were laid to extend and maintain natural gas service.

Consumers' Gas Company of Toronto, Ontario, Canada, plans to extend its lines in 1959 to Peterborough where it has recently acquired the municipally-owned gas distribution system, complete the conversion of the system from manufactured to natural gas by spring of 1959, and to extend service to the Ottawa Valley and to new subdivisions and customers in communities now served.

Consumers Power Company, Jackson, Michigan, plans to spend about $56,600,000 in 1959 on gas projects to supply its customers in 29 Michigan counties. With a waiting list of 125,000 applicants for gas house heating service, company has contracted for a large additional supply of natural gas from Texas and Louisiana, and scheduled several major projects to receive, store, and distribute the increased gas supply.

Iowa Electric Light and Power Company, Cedar Rapids, Iowa, has allocated $2,570,000 for work to be done in 1959 on main replacements, extensions, and meters. Included is an estimated $1,600,000 for gas distribution systems for some 21 new towns in which the company holds franchises and is awaiting federal approval for service. Towns awaiting gas service are: Dysart, Traer, Gladbrook, Tama, Toledo, Sibley, Kanawha, Corwith, Vinton, Oelwein, Hazleton, Hubbard, Wellsburg, Garrison, Garwin, Goodell, Holland, Gilbert, Roland, Winthrop, and George.

Central Missouri Gas Company, Kirksville, Missouri, has received a state PSC "okay" to construct and operate natural gas distribution systems in Kirksville, Queen City, and Greentop, in northeastern Missouri at a cost of $2,130,000. FPC has yet to approve plan to purchase gas from Michigan-Wisconsin Pipe Line Company.



Big Valves on Big Job. Three 30-in valves on a "tee" intersection of a 30-in. main project installed by Northern Illinois Gas Company in the near west suburban area of Chicago are part of a $175,000 project that included installation of 2500 ft of the big pipe. Two valves in place will control flow on the feeder main, and valve being bolted to the tee will control flow to the distribution main. Valves are gear operated, have water-tight housing that eliminates need for vaults. During 1959, NIG will install an additional three miles of 24 and 30-in. main to expand service to the area.

Houston Natural Gas Company, Houston, Texas, has completed a tie-in project linking its Kingsville distribution system to a supplementary gas supply in Richardo field, south of the Naval Air Station by building a new measuring station and laying approximately 5 miles of 8-in. between the field and an existing measuring station.

Worcester Gas Light Company, Worcester, Massachusetts, plans to spend more than $5,000,000 during the two year period 1958-59 on expansion of its facilities to supply the 33 communities it presently serves. More than $2,250,000 was spent in 1958 for capital expenditures with about 70 percent of this amount used to supply gas service to new homes. About 2525 new heating customers were added during the year.

Pacific Lighting Corporation, San Francisco, California, has set another record construction budget of $95,000,000 for 1959. Of this amount, almost $39,000,000 is to bring additional gas from out-of-state to Southern California. Construction is being undertaken by Pacific Lighting's three subsidiaries, Southern California Gas Company, Southern Counties Gas Company, and Pacific Lighting Gas Supply Company.

Pacific Gas and Electric Company, San Francisco, California, plans to spend about $35,000,000 in 1959 for natural gas operations to add more than 500 miles of distribution mains and 50,000 new customers. About $11,000,000 has been labeled for new service centers, new office facilities, and other miscellaneous items.

Arkansas Louisiana Gas Company, Shreveport, Louisiana, has been given permission to lease and operate municipally-owned gas distribution systems to be built in Portland and Montrose, Arkansas. The two towns plan to spend $229,500 and $120,500, respectively, out of bond proceeds to build the local gas distribution systems.

How to Accomplish More With Less Work

Jack E. Bedford

TOP MANAGEMENT and middle-management men in the gas distribution industry keep up-to-date on their work by following a simple formula. This idea keeps their schedule current and is flexible enough to make it easy to handle unexpected situations without disrupting the complete routine.

Successful executives have followed this plan for a long time. It is not new — it is time tested as a technique of modern management. The formula has these three parts:

1. **Refer,**
2. **Defer,**
3. **Delete.**

Refer

When an executive refers a duty to someone else in the organization, it can be a time-saver for everyone. This can be done to avoid a time-wasting task, to bring special skills and abilities into the picture, or to train another man to take on responsibilities.

For instance, a top executive is called on to give a speech. It is an honor and good public relations for the firm. It cannot be deferred or deleted — it must be done.

Some executives will spend a day, two days or a week in writing the speech. It will be good. But, in 20 minutes or a half-hour it is over. The time and the dollar cost of this executive task may be tremendous. And, during this speech writing time many more important tasks and decisions may be deferred.

However, the successful executive who follows the management formula will refer this to someone else. It may be the public relations department, the advertising department, or a ghost writer who works on a fee basis. By referring the job to someone else, the executive has a day, two days or a week that can be devoted to top level management decisions that will build profits for the utility.

Another time when it is best to refer the task to someone else is for executive development. For instance, a production schedule or a sales budget is needed. In deciding whether to do it himself or to refer it to another man, the time element will enter the picture. The top executive knows he can do the job quickly and efficiently. He is better qualified than anyone else in the firm to handle the task.

When the executive refers the work to someone else, however, he is providing executive development. The person who is assigned the job grows in management stature. He learns how to prepare the budget or schedule. He gains self-confidence . . . and his loyalty increases many times.

A maxim of successful management is: *When two partners always agree — one is unnecessary.* This is another time when referral may be the best management strategy. Some management-minded executives follow the practice of always referring important decisions to someone else.

This provides another viewpoint and helps make the final decision better. And, with the referral of the decision to someone else, the top executive can study the problem more objectively and perhaps provide the necessary checks and balance needed for wise management.

Defer

Successful gas executives do not "put off until tomorrow" tasks that need to be done today. Yet, on every executive's daily schedule there are items that do not have a deadline. These are the items that can be deferred to provide more time for the "must" items and special situations that do develop during the day.

For instance, many tasks facing an executive are in the "when I have time" category. A sales budget, due the first of December, for instance, might be on an executive's schedule in October. He thinks about it, but because there

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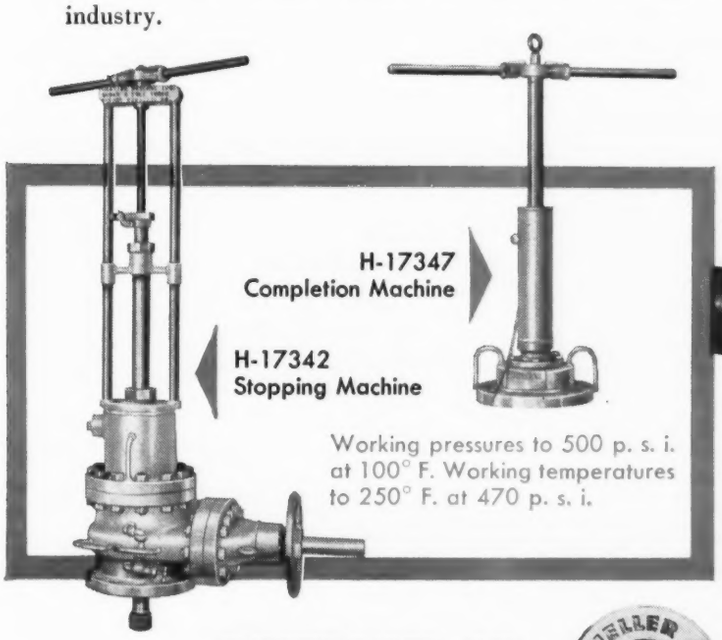
These design features are typical of the attention to detail in research, design and engineering that becomes a part of every Mueller product produced for the gas industry.



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isn't much urgency, puts off actually doing it.

That is not what is meant by defer. Each day that a task is deferred this way takes time. It uses up a certain amount of concentrating time of the executive each day it is deferred. A better way of handling this is to defer it to some specific date in advance of the first of December deadline.

Another time when gas industry executives can use the defer phase of this management formula is when there is not enough time to complete the job. For instance, some management tasks require considerable time. There is not enough time to complete this job and still handle other more urgent work. It is best to defer this to a later date when there will be plenty of uninterrupted time to complete the job.

Don't "put it off" . . . transfer it to some better time.

✓ Delete

Every executive has some things on his daily schedule that are not necessary. Some are tasks that have changed in importance since entered on the program. Others are things that have been done or handled by someone else in the firm.

Naturally, this does not mean to go over the daily work schedule and delete all things that can't be referred or deferred. It might be the easy way to clear the desk, but it is not typical of a successful top level executive.

Minor and unimportant things on a daily schedule get there for some reason. A quick review of the reasons and recent developments will indicate what items should be deleted.

For instance, a management consultant discovered that one executive was always loaded down with work. His office secretary wrote more letters than any other in the firm. Yet, this executive always had some odds and ends of unfinished business at the end of the day.

Analysis revealed that this executive personally answered all letters addressed to him. Even direct mail advertising with his name filled in on a form letter got an answer. When "file 13" was used to delete these irrelevant and unimportant letters, this executive's efficiency increased.

✓ Do

Fifteen minutes analyzing the daily work schedule and application of the REFER — DEFER — DELETE formula will be a quarter hour well spent. This will reduce your calendar to a reasonable day's work . . . that can be done in a minimum of time and with professional executive skill. * *

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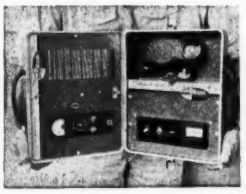

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FISHER Research Lab., Inc.
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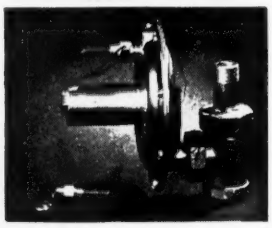
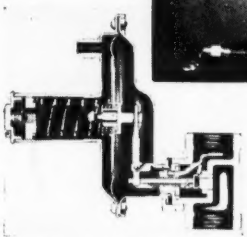
GAS SERVICE REGULATORS FOR CONVERSION OR PRESSURE ELEVATION

A REGUATOR, BREATHER VENT AND CATHODIC INSULATOR IN ONE PACKAGED UNIT





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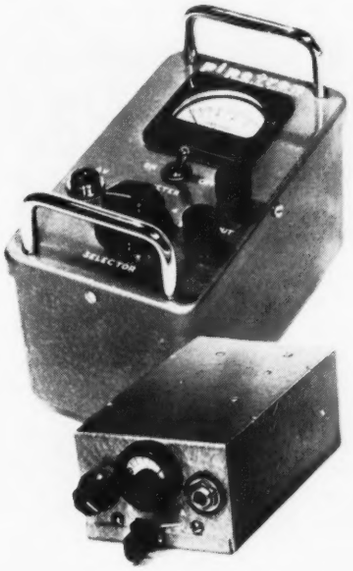
PRODUCT PARADE

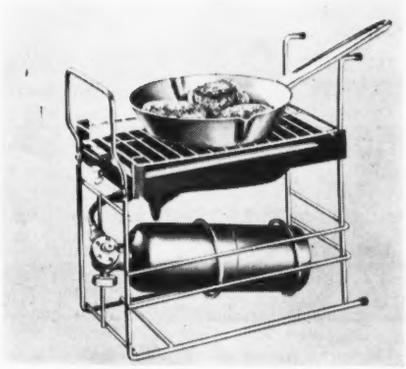
MATERIALS – EQUIPMENT – SERVICES

DETECTOR FOR INSPECTING COATING ON BURIED LINES — formerly made and used in the field by a leading utility — is now being produced by Pipetron Company. Portable unit inspects buried pipe and locates pipe and shorts between pieplines; consists of a transmitter, miniature receiver, search



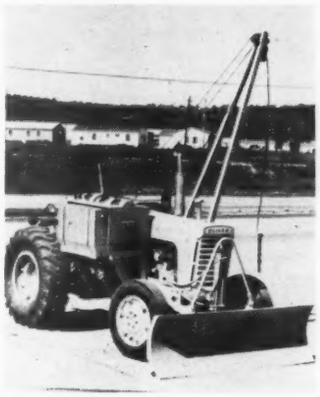
coil, and several accessories. Unit locates flaws or "holidays" in protective wrap of pipe buried several feet deep; can be used to inspect coating shortly after burial to reveal any damage caused by backfill or for regular maintenance, can be used to reduce cathodic protection costs.

CIRCLE (1) ON THE REPLY CARD



COOKING WITH CATALYST. New outdoor gas-fueled appliance—a combination portable stove, vertical broiler, and radiant heater — is now being sold by Devonair Products, a new division of Oxy-Catalyst, Inc. Unit uses catalytic method of producing flameless infra-red radiant heat to provide coking effect comparable to that attained with charcoal or resistance-wire type electric broilers. Revolutionary catalytic burner is permanently coated wire-mesh screen that burns propane gas flamelessly, turns cherry red to radiate true infra-red heat energy. Single disposable propane gas cylinder operates for 2 to 6 hours.

CIRCLE (2) ON THE REPLY CARD



MIDWESTERN'S NEW SIDEBOOM for rubber-tired tractors can lift 7000 lb with all-hydraulic operation. Unit has a friction clutch for free spooling the load line. Sideboom is presently designed for the Oliver 770 industrial wheel tractor, however, modifications are underway to adapt sideboom for other model rubber-tired tractors.

CIRCLE (3) ON THE REPLY CARD

REAR-MOUNTED TRENCHER ATTACHMENT for tractors, developed by Deltec, Inc., can be detached quickly to free tractor for power tilling, grading, etc. Trencher does not interfere with front-mounted equipment. Fits any wheel-type tractor with a live power take-off and ASAE Standard 3-point hitch. An "Incher" device moves tractor forward at correct rate of speed to allow steel cutters to dig 6 to 14 in. wide trenches. Operates at speeds up to 500 ft per hr, and digs maximum 4 ft deep trench with standard equipment. Boom extension is available for deeper trenching. Soil is conveyed to right of cut with screw-type earth mover.

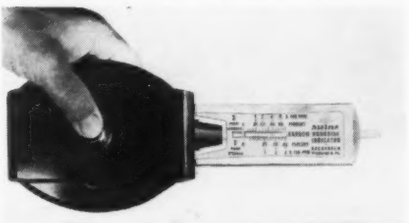
CIRCLE (4) ON THE REPLY CARD

HIGH-PRESSURE PNEUMATIC PISTON OPERATOR, manufactured by Fisher Governor Company, is designed primarily for application where more force and higher stroking speeds are required than are available from diaphragm operators. Unit includes enclosed positioner mounted on cylinder, suitable for wide range of instrument signals. Operates on any supply pressure up to 150 psi, and creates stem forces from 1500 to 12,000 lb. Unit is easily reversible in the field, and includes a weatherproof housing over the positioner and pressure gages.

CIRCLE (5) ON THE REPLY CARD

DAVEY COMPRESSOR COMPANY'S new line of portable rotary air compressors use rotor blades made of a special solid, lightweight material for greater wear resistance than those used in most rotary machines. A patent has been applied for on both blade design and material. Line is offered under tradename Davey Hydrovane Rotary, and includes portable compressors of 125 to 600 cu ft per min capacities.

CIRCLE (6) ON THE REPLY CARD



POCKET-SIZE CARBON MONOXIDE INDICATOR, available from Bacharach Industrial Instrument Company, is mechanically-operated, has no electrical circuit and may be used in the presence of flammable gases. It indicates percent CO by measurement of length of a stain developed in an indicating tube; color comparison is eliminated, and visual color response of operator cannot affect results. Indicator is ideal for safeguarding life wherever carbon monoxide hazards may exist.

CIRCLE (7) ON THE REPLY CARD

NEW LOW-PRESSURE DIAPHRAGM CONTROL for air or gases manufactured by Mercoid Corporation is FM approved, and features external adjustment, calibrated dial, visible on-off circuit, and a sealed mercury contact switch. Control incorporates single acid resistant diaphragm that actuates a mechanism for opening and closing a hermetically sealed mercury switch. Fully automatic and semi-automatic types are available.

CIRCLE (8) ON THE REPLY CARD

FREE—Alphabetical list of 120 **Gas Companies that have been exempt from FPC regulation** under the Hinshaw Amendment to the Natural Gas Act of 1955. Available to all readers using the "ready-reply" card to obtain additional information on other items described in *Product Previews* and *Bulletin Board* departments of AMERICAN GAS JOURNAL.

CIRCLE (9) ON THE REPLY CARD

PLASTIC TRAFFICONES, ADAPTERS, AND ACCESSORIES made of polyvinyl chloride have been developed by Interstate Rubber Products Corporation. Cones come in three sizes—12, 18, and 28; are heavily constructed and engineered to resist greater wind velocities. Pigment is impregnated throughout compound to produce brilliant red and yellow colors for better visibility and no maintenance.

CIRCLE (10) ON THE REPLY CARD

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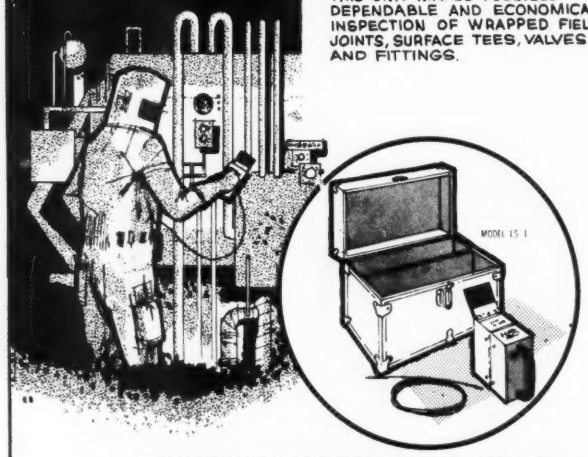

DISTRIBUTORS: Crutcher-Rolfs-Cummings Inc., Houston, Texas • Remco Manufacturing Co., Inc., Tulsa, Oklahoma • Canadian Equipment Sales & Service Ltd., Edmonton, Alberta, Canada • Bob Herrick, Rentals & Service, Harrisburg, Penna. • Falcon Line Products Corp., Elizabeth, N. J. • Export Agents . . . Frazer & Hansen Ltd., San Francisco, Calif.

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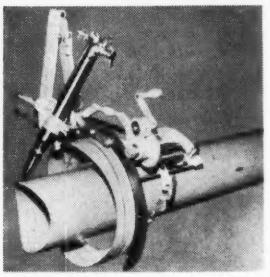
PRODUCT PARADE



DESIGN IMPROVEMENTS have been incorporated in two attachments for H&M's pipe cutting and beveling machines. New model shape cutter attachment designed to cut various shapes of pipe intersections automatically, is lightweight and features fast mounting. A new free-wheeling roller assembly that turns a full 360 deg has been added to the out-of-round attachment. Roller rides pipe surface and automatically makes corrections for any imperfections.

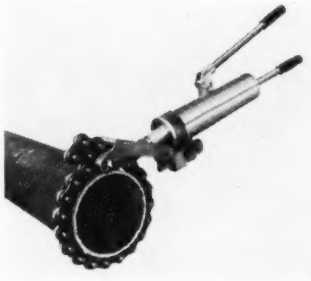
CIRCLE (11) ON THE REPLY CARD

SELAS' IMPROVED AND ENLARGED LINE of multiport P-R Gas-Air Burners combine positive flame geometry with maximum heat release and low turndown through its multiport refractory screen that breaks up the flame front into a large number of small concentrated "flat face" round flames of high intensity. Wide operating range of the burners with any commercial fuel gas permit their use for great number of applications including high temperature alloy brazing, glass fire-polishing and forming, heat treating materials, heating solder pots, and textile singeing.

CIRCLE (12) ON THE REPLY CARD

HYDRAULIC PRESSURE does all the work on Spring Load Manufacturing Corporation's new cast iron pipe cutter. Unit requires no turning, no vise, no muscular leverage and will cut in any position, 2 to 6-in. cast iron or Duriron pipe. Adjusts like a pipe wrench.

CIRCLE (13) ON THE REPLY CARD.



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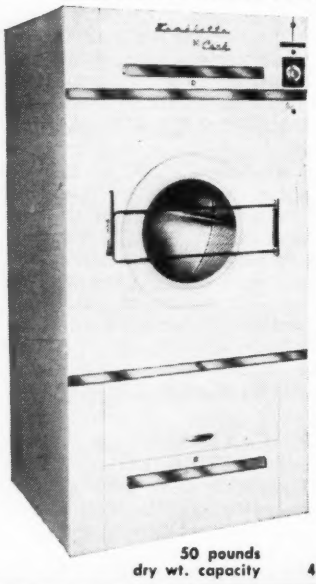

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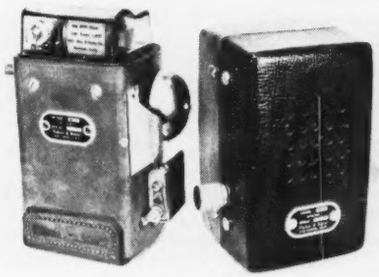
NEW ONE-MAN OPERATED TRENCHER, developed by Arps Corporation to succeed their Model M, is a medium size trencher for such jobs as gas lines, water services, street lighting, and electrical and telephone cable. Can be moved short distances under its own power at 2¾ miles per hour, or skid-loaded on pickup truck or small trailer for long distances. Unit has 5 digging widths — 2¾, 3½, 4, 6, and 8-in. up to 54-in. deep. Digging speed varies from 0 to 1200 ft per hour.

CIRCLE (14) ON THE REPLY CARD



TINKER & RASOR'S HOLIDAY DETECTOR for inspecting protective coatings on pipe has been re-designed to provide a much sturdier detector for strenuous field use. Unit is encased in a 2-color Royalite case made of heavy durable plastic material; signal bell and relay are now totally enclosed, and 2 standard flashlight batteries are all that is needed for the bell battery. Inspection voltage on the new model remains the same—67½ volts.

CIRCLE (15) ON THE REPLY CARD

FIRE FIGHTING SPHERE, Ansul Chemical Company's new multi-purpose fire extinguisher, features unique spherical design, one-hand operation, and disposable cartridges. After use, the spherical charge is thrown away and a new cartridge is installed. Unit is only dry chemical recharge approved by Underwriters' Laboratories. Lightweight unit is as effective as 8 pump-type 1-quart carbon tetrachloride extinguishers.

CIRCLE (16) ON THE REPLY CARD

TWO NEW ITEMS from Plan Hold Corporation include a loose-leaf binder for charts, maps, and large sheet material, and a new tube filing system for rolled prints, charts, drawings, maps, tracings, etc. Loose-leaf binder accommodates up to an inch thickness of sheet material without mutilating sheets, requires no hole punching. Furnished with rigid Leather-wood covers, unit comes in three standard sizes: 12 by 18; 18 by 24, and 24 by 36. New tube filing system consists of modular steel encased Duro tubes in units of 4 tubes per roll file; each unit measures 12 by 4 in. high by tube length. Two tube lengths—27 and 33 in.—are currently available. Units have special "slide together" stacking feature.

CIRCLE (17) ON THE REPLY CARD

NEW ANTI-SEIZE SEALANT from Armite Laboratories stops spiral leaks from large diameter threads and coarse fittings and leaks in welded flanges that have become oval or distorted. Non-corrosive, non-hardening lead compound, suitable for extremely high temperatures (—350 F to +2987 F) and pressures (50,000 psi hydraulic).

CIRCLE (18) ON THE REPLY CARD

NEW FORK LIFT ATTACHMENT for Napco's 4-wheel drive, 4-wheel steer crab tractor is now available. Unit lifts 2500 lb to maximum height of 21½ ft. Installation of Crablift does not interfer with operation of rear mounted equipment such as a backhoe attachment.

CIRCLE (19) ON THE REPLY CARD

time tested...
meter proved
Lancaster DIAPHRAGMS
complete assemblies • metal-rimmed • all-leather
Lancaster complete diaphragm assemblies for 1-A Sprague meters adjust to "watch-movement" accuracy regardless of case thickness or location of the main movement or carrier wire side bracket.
Grooved metal rims have added strength, rigidity. Leather is positioned in groove with precise machinery to assure uniformity of amount of leather and depth of pocket. Endless metal ring holds leather to rim with uniform pressure.
Lancaster-processed leather is soft, supple — yet firm, normally retains oil 20 years or longer.
All-leather, metal-rimmed or complete assemblies, Lancaster diaphragms improve accuracy, lengthen performance and minimize servicing.
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"a meter is only as accurate as its parts"
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insulated meter connections

permanent molded-on design simplifies assembly

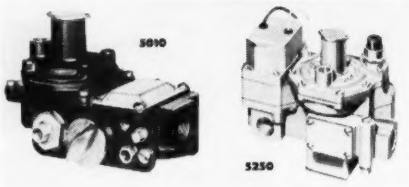
- Insulation covers pilot flange and extends up the body—minimizes possibility of short circuits caused by moisture. No loose parts.
- Tough Nylon insulation seals tight, resists crushing. High dielectric strength eliminates electrolysis.
- Insulated meter connections are interchangeable with standard connections—accepts standard caps and washers. Reduces inventory problems.

Ask your American representative for Bulletin 308 describing all insulated and standard meter connections.

AMERICAN® METER COMPANY
INCORPORATED ESTABLISHED 1836

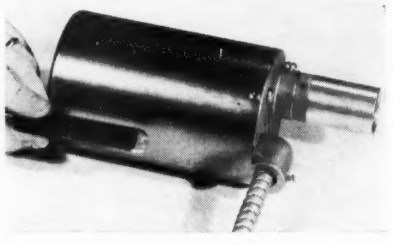
Executive Offices: Philadelphia 16, Pa.
Sales offices in principal cities.

WHAT'S NEW IN CONTROLS



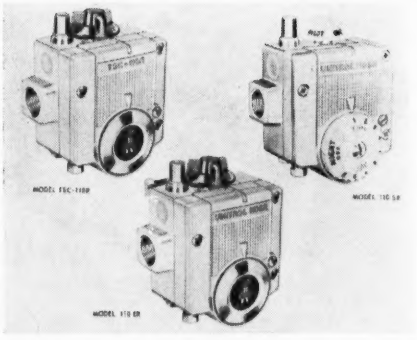
Two new gas controls have been introduced by Controls Company of America. A new Series 5250 single unit gas control for furnaces and unit heaters is an all-in-one package that does the work for four individual controls. Unit has four built-in features that include a pressure regulator, 100 percent safe shut-off, safety-assured lighting, and thermomagnetic safety pilot. It is designed to fit into gas-fired equipment without design changes. Can be equipped with an electro-magnetic thermostatic operator for use with all types of gases — including LPG; large built-in pilot filter is optional. CCA's new Series 5010 control is a small, compact control center that does the work of six conventional controls and is designed for use in wall heaters, clothes dryers, space heaters, and unit heaters. Unit is easily adaptable without design changes, mounts in all positions. Has built-in "A" and "B" cocks or flow interruptor, safe lighting, 100 percent safe shut-off, and can be converted to electrically operated thermostatic control or can be used with non-electric automatic temperature control accessories.

CIRCLE (25) ON THE REPLY CARD



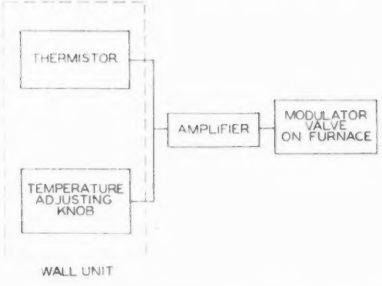
Ultraviolet light emission by flames of all types — even spark ignition — is the basis for a new universal detection device for all types of commercial industrial heating or processing burners that has been developed by Minneapolis-Honeywell Regulator Company. Heart of the new flame detection system is an ultraviolet light sensitive tube. The tube works with an amplifier to add up impulses of electrical energy generated by the tube as it counts ultraviolet rays in any type of flame. Responding only to ultraviolet light, the sensor is not affected by hot refractories, incandescent light, hot metal parts, or flickering radiation in the visible or infrared regions. It makes possible the application of detection systems to exothermic gas generators, radiant cup burners, and flame hardening machines. Spark ignition — an excellent source of ultraviolet radiant energy — can also be monitored by the device. The system developed by Honeywell is self-contained, is easily "sighted in," requires no special wiring, has an ambient temperature rating of 50 to 135 F, and can be used to sight temperatures up to 2200 F without back light effect. Models available operate on 120,208, or 240 volts at 50/60 cycles.

CIRCLE (26) ON THE REPLY CARD



Ultracompact, precision-built series of controls for smaller appliances is being introduced by Grayson Controls Division of Robertshaw-Fulton Controls Company. Basic in the new series is the TSC-110 R, a manually operated control for console, bathroom, vented, and recessed wall heaters. Model incorporates an "A" cock, a "B" cock, automatic pilot, and gas pressure regulator. Control is also available with a pressure tap. For automatic appliance control, the basic model is available with a snap-action, hydraulically-operated thermostat that is sensitive to return air flow; this version is called 110 SR. Automatic operation utilizing a wall thermostat is accomplished by addition at factory of a 24-v. heat motor type automatic valve to produce model 110 ER.

CIRCLE (27) ON THE REPLY CARD



Electronic Modulation designed for use with gas-fired forced-air furnaces has been developed by the Maxitrol Company. New system produces continuous, non-cyclic heat in which the burner flame is changed to counterbalance heat loss in the home. Termed the "Selectra System" by its manufacturer, the new modulator system features a wall temperature control with a 55 to 85 F range. Unlike mechanical modulation systems — which have full on-off burner operation and intermittent air movement — the new system continually adjusts the gas burner and air is in continuous movement at slower speed. Temperature sensing is achieved by use of a thermistor, which produces a current for control; this current is amplified by a transistorized circuit to energize the solenoid power head of the modulator valve. In event of power or electronic failure, system operates as regular mechanical system. System ultimately can be designed to use in hot water heating applications.

CIRCLE (28) ON THE REPLY CARD

Packaged, centralized control systems using custom-engineered control panels and incorporating a wide range of sequencing, supervising, indicating, and power controls for heating and various other applications are described in a new bulletin now available from Protection Controls, Inc. Included is discussion on advantages of centralized control and custom engineering to meet specific operating or safety requirements.

CIRCLE (29) ON THE REPLY CARD

NEWSREEL

GOOD DEAL FOR CUSTOMERS? Proposed legislation in Texas to establish a public utility commission to regulate privately-owned gas, electric, and telephone utility companies would be financed by a quarterly tax of ¼ of 1 percent on utility gross receipts — total of 1 percent annually. This cost undoubtedly would be added to rates. If bill introduced in Texas legislature is approved, a three-member commission would be appointed, each member to serve a 6-year term at an annual salary of $17,500. The state's Railroad Commission now reviews disputes between cities and gas utilities. Texas and Iowa are only two states now without state public utilities regulatory bodies.

LEA COUNTY GAS COMPANY has been authorized by the FPC to acquire gas properties including five communities in Sherman County, Texas, and Cimarron County, Oklahoma, from Southwestern Public Service Company for $4,600,000. Estimated total annual sales for 1961 are 426,640,000 cu ft. Company currently serves 33,000 customers in El Paso area, and 4500 around Silver City, New Mexico.

IN NEBRASKA, attorney general's office has held the state highway department must pay costs of relocating facilities of utilities when necessitated by highway construction. In reply to an inquiry from Deputy State Engineer Henry Schlitt, Assistant State Attorney General Harold S. Salter said that "the state must pay the utility all costs which are non-betterment."

"BOILER FUEL" SALES BARRED. FPC has granted United Gas Pipe Line Company a "budget-type" application for construction and operation of not more than $1,500,000 in new facilities, with no single project to cost more than $400,000 to enable it to make direct industrial sales of natural gas on the condition that "no facility shall be used to deliver natural gas for boiler fuel for the generation of electricity." The facilities to be built during the period ending December 31, 1959, would enable UGPL to make direct industrial sales totaling 25,794,550,000 cu ft of natural gas.

NORTHERN ILLINOIS GAS COMPANY is continuing to develop its Troy Grove underground storage project on the outskirts of Chicago. Explorations to date indicate possibility of storing gas in three separate sandstones. NIG has been injecting gas into the lowest section of the structure since last July with satisfactory results. NIG expects to have 3-billion cu ft of gas in the lowest section of the project by December 1959 and 6-billion cu ft in the various formations by December 1960. If initial testing is successful, test withdrawals of about 1-billion cu ft might be possible during the 1959-60 heating season.

LEGISLATION THAT WOULD HAVE GIVEN Wyoming's PSC regulatory control of direct industrial sales of natural gas by interstate gas lines has been rejected in the state's House of Representatives.

SUITABLE UNDERGROUND GAS STORAGE reservoirs near large cities are getting renewed interest in Russia because the USSR says it "cannot spare steel to provide surface storage tanks" to handle increased gas demands resulting from the latest Soviet "Seven-Year Plan." Intensive geological prospecting and drilling is being focused first on areas around Moscow, Leningrad, Gorky and Bryansk, all to receive large amounts of gas from long-distance gas transmission lines now under construction.

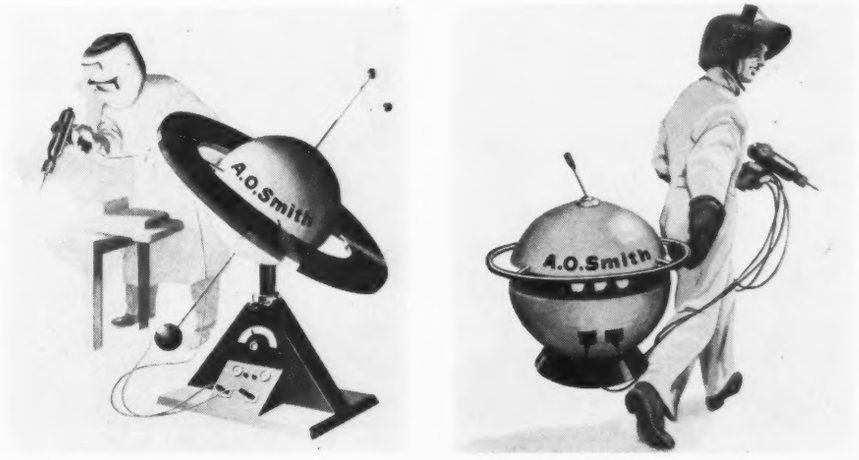
PACIFIC GAS AND ELECTRIC COMPANY has asked the California PUC for a "green light" to develop a 3.25-billion cu ft natural gas underground storage field near Winters, California, at an estimated cost of $2,591,260. Interests in the field were obtained by PG&E under a 1955 authorization by the PUC and PG&E now seeks a certificate of public convenience and necessity to construct, operate, and maintain the storage project in the partially depleted Pleasant Creek gas field. If approved, first stage of development would begin in April.

PROPOSED CONSOLIDATION of Brooklyn Union Gas Company and Brooklyn Borough Gas Company has been approved by directors of the two companies on the basis of ¾ of 1 share of Brooklyn Union common for 1 share of Brooklyn Borough. The consolidated company would continue to be known as The Brooklyn Union Gas Company and would serve the entire boroughs of Brooklyn and Richmond and a part of the borough of Queens, if approval is given by stockholders of both utilities and the New York State PSC.

CARTIER GAS CORPORATION, Montreal, Ontario, Canada, has been granted a natural gas franchise by the City of Magog in the St. Lawrence River Valley. This is the company's third prospective gas market. Others are Granby and Three Rivers. Cartier, subsidiary of St. Maurice Gas Inc. and Consumers' Gas Company, Toronto, plans a $15,000,000 to $30,000,000 natural gas line from Montreal to Quebec City. A second firm, Gaz National Inc., is competing with Cartier for rights to distribute natural gas in the same area but to date has not lined up any franchises.

ST. LAWRENCE GAS COMPANY, Ogdensburg, New York, has asked the FPC for permission to import gas from Canada to serve the St. Lawrence Valley of New York state with Canadian gas. The new company, sponsored by Consumers Gas Company of Toronto and New York interests, has secured franchises to serve 15 communities in the section stretching from Massena to Ogdensburg. Gas would be supplied by Consumers' Gas and would come from the already constructed Trans-Canada gas pipeline between Toronto and Montreal. Area is not presently being served with natural gas. Niagara Mohawk Power Corporation, a combination gas and electric utility that serves electric energy to a large section of the state, plans to extend its gas service into the area and is opposing the St. Lawrence plan.

WASTE KING has acquired a controlling interest — 67 percent of the voting shares — in Cribben and Sexton Company of Chicago. The West Coast appliance manufacturer obtained 156,552 ½ shares of common stock on all exchange basis of one share of Waste King common stock plus $12.50 for each two shares of Cribben and Sexton common. Plans are to operate Cribben and Sexton as an autonomous company with no changes in the staff.



Welding Machines of the Future. A. O. Smith Corporation will exhibit a number of devices portraying welding techniques and equipment of the future at the American Welding Society Convention April 7-9 in Chicago. One device, called "Stellarweld," theoretically draws its electrical operating power from a thermonuclear source. Another unusual model to be displayed is the "Vega," a portable, anti-gravitational welder that floats at a predetermined level above the plant floor and can be pulled to the welding site with practically no effort. Unit also would draw its power from a self-contained atomic source. Although working models are still several years away, units to be displayed embody principles entirely plausible, R. J. Keller, chief engineer of A. O. Smith's Welding Products Division, said.

AARON WACHTER, director of research, Shell Development Corporation, has been named to receive the 1958 Frank Newman Speller Award in recognition of achievement, in corrosion engineering by the National Association of Corrosion Engineers of Houston. Dr. Wachter, 1954 president of NACE, has been active in corrosion research for many years, and head of Shell Development's corrosion department since 1938.

DR. FRANK K. SCHOENFELD, vice president-research of the B. F. Goodrich Company, will receive the *Industrial Research Institute Medal for 1959* next May at the Institute's annual meeting. The medal is awarded to honor "outstanding accomplishment in leadership in or management of industrial research which contributes broadly to development of industry or the public welfare." Schoenfeld joined Goodrich in 1927 and has been vice president-research since January 1954. His early work as research chemist on vinyl resins led to his appointment as manager of Koroseal research and development in 1939.

HUGH P. GODARD, Aluminium Laboratories, Ltd., has been elected president of the National Association of Corrosion Engineers for the 1959-1960 term. He and other officers of the association will be installed at the 15th annual conference to be held in Chicago, March 20. George E. Best, Solvay Process Division, Allied Chemical Corporation, has been elected vice president; and A. L. Stegner, Tennessee Gas Transmission Co., treasurer.

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NEW ALUMINUM BODY AND TOP
CAST IRON INLET UNIT
V-TYPE STAINLESS STEEL BAND

ONLY ONE STAINLESS SCREW with nut to remove for complete orifice and valve pocket. Permits exchange of diaphragm case without removing inlet unit from line.

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3. Internal diaphragm operated relief valve for complete over pressure protection
4. Internal diaphagm relief and automatic cutoff

REYNOLDS REGULATOR CO.
ANDERSON, INDIANA

A.G.A. DISTRIBUTION CONFERENCE, scheduled for April 6-9 in Cincinnati, will cover everything from small foreign cars to "rubber yardsticks" in a four-day program featuring three "general" sessions and 15 sessions on specific subjects. More than 100 speakers are slated to discuss every phase of gas distribution operations, including construction, maintenance, corrosion, vehicles, meter sizing, personnel training, customer service, and automation in gas dispatching.

33RD ANNUAL NEW ENGLAND GAS ASSOCIATION MEETING, set for March 19-20 in Boston, will be highlighted by programs on "Public Safety and Its Importance to the Gas Industry;" a panorama on the national gas industry entitled "Programs for Progress;" and a session on gas air conditioning and the "Gold Star" promotion story. Awards for outstanding service will be presented on March 19 at a general session featuring an address on "What's the Score and What Can We Do?" by Robert Welch, editor of *American Opinion*.

SOUTHERN GAS ASSOCIATION'S 51ST ANNUAL CONVENTION, calendared for April 27-29 in the Crescent City (New Orleans), will center its program on the theme, "Decade of Decision — the 1960's." Speakers at every session will key their addresses to the challenge of the next decade, meeting the problems it may bring, and offering guidance on making the decisions that will determine the gas industry's future as a major supplier of energy, notes Carl E. Cloud, S.G.A. president and president of MidSouth Gas Company. Other highlights of the meeting will include talks by Tony Whan of Los Angeles, often cited as "salesman of the year," and William Hazlett Upson of Middlebury, Vermont, author and creator of "super-salesman Alexander Potts" of the "Earthworm Tractor Company."

CARLON PRODUCTS CORPORATION, manufacturer of plastic pipe, has purchased assets of the United Pipe and Tube Company of Lubbock, Texas. Facilities will be operated under the Carlon name and will serve the West Texas area with Carlon's line of plastic pipe and fittings including those made of PVC, Kralastic and polyethylene. Plant will also produce plastic-coated-steel pipe for gas distribution and electrical conduit applications. Harold Mewhinney has been appointed plant manager of the new facilities, as well as the Corsicana plant in East Texas. Purchase of United Pipe is part of Carlon's current expansion program which during the past six months has included construction of new million-dollar facilities at the Aurora headquarters, and construction of a new extrusion plant in Compton, California.

OHIO VALLEY GAS COMPANY has taken over service of natural gas in a 24-town area previously operated by Manufacturers Light and Heat Company. Both Ohio Valley and Manufacturers are subsidiaries of Columbia Gas System. District headquarters have been established in Steubenville and Kenneth E. Harsh, former Salem district manager for Ohio Fuel Gas Company, has been transferred to Steubenville as manager of the new district. Five other men from the Salem staff — Paul P. Warvel, Harold W. Lowman, Robert L. Peters, Ernest R. Gardner and Bruce W. Cox — will transfer later this year to the new district.

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Man with experience in gas or water distribution network analysis wanted to sell the McIlroy Fluid Network Analyzer to gas and water utilities. Applicant must have basic knowledge of electricity. Position offers opportunity to travel extensively throughout the United States and Canada. Salary arranged. Submit photo and resume complete with education, experience and references.

Write to S. C. Jordan, Sales Manager, The Standard Electric Time Company, 89 Logan Street, Springfield, Massachusetts.

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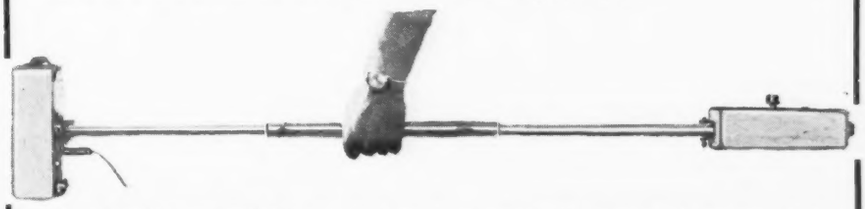
THE NEW MINIATURIZED

WILKINSON Line Locator Model W-3

This radically new, powerful transistorized sub-surface locating instruments weighs only four pounds and is one-fourth the size of conventional pipe locators.



It's as handy as a flashlight; the transistors will rarely ever require replacing; non-leak mercury cells will last at least ten times longer. The maintenance is trivial. Molded glass fibre instrument cases insure maximum protection. The aluminum connecting handle telescopes to 17" and the entire instrument is packed in a substantial carrying case.

WILKINSON PRODUCTS COMPANY

3987 Chevy Chase Drive, PASADENA 3, CALIFORNIA. SYlvan 0-4314

BULLETIN BOARD

CATALOGS – BROCHURES – TECHNICAL DATA

NEW ODORIZATION MANUAL just completed by Natural Gas Odorizing is available to training schools, industry media, and service people. More than 40 pages cover principles of gas odorization, soil penetration, installation and maintenance of odorizing equipment, a discussion of specifications, the reasons for different type odorants as well as specific operating and physical characteristics of captan odorants.

CIRCLE (61) ON THE REPLY CARD

PLANNING GUIDE for participation in a convention or trade show and a check list for 1, 30, 60, and 90 days prior to show's opening are available in a new booklet from Manpower, Inc. entitled, "100 Suggestions for Convention & Trade Show Exhibitors." Booklet gives pointers on show evaluation, cost factors, exhibit planning, staffing the booth, building, dismantling and shipping the booth, and sales presentations.

CIRCLE (62) ON THE REPLY CARD

NEW 4-PAGE BULLETIN describes Parson's economy model 130 "Trenchliner," a wheel-type unit that digs trenches 12 to 24 in. wide at depths of 5¾ ft. Digging speeds from 1 to 18 ft per minute are possible. Photographs and feature-by-feature explanations are also given.

CIRCLE (63) ON THE REPLY CARD

NEW BROCHURE from American Meter Company describes the 25B and 35B Ironcase meters giving complete details on capacities, construction, and performance of both meters. Meters can be supplied for use with sewage gas, acetylene, oxygen and other special services.

CIRCLE (64) ON THE REPLY CARD

PANELLIT'S NEW BULLETIN ON CENTRALIZED CONTROL SYSTEMS illustrates and describes the design approach, materials, construction, and modern facilities used in manufacturing a variety of centralized control and data presentation systems.

CIRCLE (65) ON THE REPLY CARD

NEW CATALOG on Grove Valve's G-3 series cast steel pipeline gate valves comes complete with dimension drawings and figures for ASA series 150, 300, 400, 600, and 900. The Seal-O-Ring valves are available in 2, 3, and 4-in. sizes in all ASA series listed, and are manufactured with either flanged or welded ends. Welded ends are bored and machined to customer specification.

CIRCLE (66) ON THE REPLY CARD

BURROUGHS NEW 220 HIGH SPEED PRINTER SYSTEM, which prints out copy direct from the computer or from magnetic tape at up to 1500 lines per minute, is described in a new 4-page brochure just published by Burroughs Corporation's ElectroData Division. Features of the transistorized system include automatic editing, built-in checking, simplified plug board programming, and on or off-line operation.

CIRCLE (67) ON THE REPLY CARD

BOOKSHELF

Titusville 1859 *by Leon McNierney, published by Vantage Press, 120 West 31st Street, New York 1, New York. Pages, 127. Price, $2.95.*

A centennial year novel about the birth of the oil industry, this book paints a vivid picture of the oil industry in the days of its infancy when the discovery of oil in the wilderness of northwestern Pennsylvania and the development of new techniques to get oil out of the ground triggered a wild spree of speculation, and made many new millionaires overnight. Geologists, inventors, farmers, roughnecks — all the people involved in the great strike — are brought to life. Story is told with realistic detail as to place and manner of life and speech in Titusville a 100 years ago. Colorful authentic account of the growth of the oil industry.

Heat Application to Commercial Range Heavy-Duty Top Sections, Part IV—Fry-Top Ranges, *A.G.A. Laboratories Research Report No. 1284, published by American Gas Association, 420 Lexington Avenue, New York 17, New York. Pages, 40. Price, $1.50.*

Fourth and last of a series published on Par Plan Research Project IA-5, "A Study of Various Methods of Heat Application to Commercial Range Heavy-Duty Top Sections," report discusses operation of top sections of heavy-duty fry-top ranges at input rates of up to approximately three times that normally found with contemporary models. At these ratings, a cold top plate reaches working temperatures at least 2½ times quicker than it does at contemporary ratings. Burner design and application for higher input rates are discussed. Application of thermostatic control of top section was also studied and found to be practical and desirable where appliance was rated at experimental high input rates. Of interest to utility sales and service presonnel who must compete with equipment using other types of energy.

The District Sales Manager, *published by American Management Association, Inc., 1515 Broadway, Times Square, New York 36, New York. Management Report 11. Pages, 100. Price, $3.*

Basic information on responsibilities and requirements of the district sales manager's complex job of training and motivating men in his charge is described in new publication. Based on actual company experience, report shows how first-line supervisor can achieve company objectives, improve salesmen's performance, and make supervisory and administrative efforts more effective. Practical guides for selecting, appraising and counseling salesmen are presented, and ways of motivating salesmen are considered.

Fluid Dynamics and Heat Transfer, *by James C. Knudsen and Donald L. Katz, published by McGraw-Hill Book Company, 330 West 42nd Street, New York 36 New York. Pages, 576. Price, $12.50.*

Another in McGraw-Hill's chemical engineering series, book presents basic aspects of fluid mechanics in such a way as to be understood and applied both to problems in fluid flow and in heat transfer. Theoretical aspects are brought together with quantitative data on both heat transfer and fluid mechanics. Specifically, material includes development of basic differential equations of fluid flow and applications to ideal flow, laminar, and turbulent flow in closed conduits, laminar and turbulent flow past immersed bodies, and flow in heat exchangers. Through derivation of certain basic equations, and conversion into more practical formulas, student is given the perspective of both theory and practice.

Techniques of Plant Maintenance & Engineering — 1958, *Published by Clapp & Poliak, Inc., New York, New York. Pages, 211. Price, $10.*

Ninth volume in a series, new book accents the increasing importance of maintenance in the nation's manufacturing industries during the past decade. Publication reports preceedings of Plant Maintenance & Engineering Conference held in 1958. Texts of 35 papers, texts of some 450 questions and answers, an equal number of questions answered in the summary of 9 round-table discussions, 42 charts, tables and illustrations are included. While most of the papers and discussions have general application to all industries, some industries are given special attention such as petroleum processing, rubber, chemical, metal fabricating, etc. A discussion on maintenance in research and development laboratories is a new feature.

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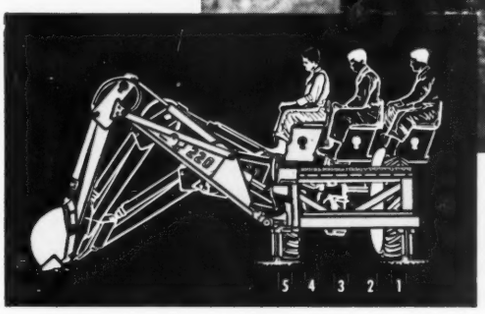

GETS READY TO FLUSH DIG
IN LESS THAN 5 MINUTES

To slide the Davis 220 into any one of five digging positions, simply loosen four cap screws, then move the mast assembly on the slide rail by actuating the boom cylinder. Retighten. Notice how seat moves along with the digging assembly so you sit right over your work for unmatched visibility. Rotary hydraulic boom swing cylinder provides 200° continuous operating arc.

the POWERFUL-New M-F Davis 220

with Hydra-Slide Positioning for Digging Assembly and Operator

The Davis Backhoe – already accepted as the industry's pattern setter, and the first machine ever to dig flush, has many new functional features that give you more profit-making advantages than any other backhoe.

The new Massey-Ferguson Davis 220 now has "Hydra-Slide" positioning so you can easily move the entire digging assembly – including the operator's seat so you're positioned right over your work – to any one of five digging positions in less than five minutes. You always look directly into the trench when digging and face the bucket when dumping.

It has new power, too, with 14,000 pounds breakaway. Increased operating pressure to 2,150 psi, combined with larger bucket cylinder shaft, gives 50% faster dumping.

All around it's a better, more powerful backhoe, with more utility than any other on the market. A demonstration by your dealer will prove it. ***Write for his name.***

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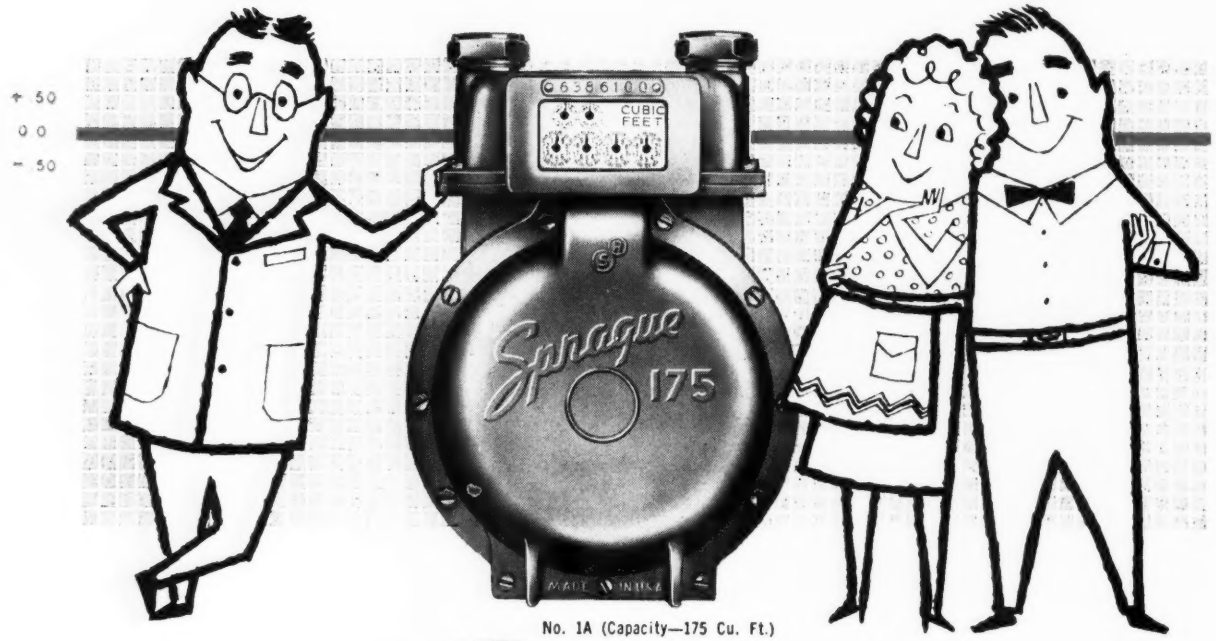
ACCURATE...



No. 1A (Capacity—175 Cu. Ft.)

BE SURE TO SPECIFY Sprague

You can install Sprague Meters with full confidence knowing that you and your customers will enjoy constant accuracy of measurement for many years under even the most difficult conditions!

Superior engineering and production skill developed during 58 years of effort devoted entirely to the manufacturing of hard case gas meters is Sprague's guarantee that you are getting the most reliable, and in the long run, the most economical gas meters.

Compare and prove to yourself — the Sprague unique 3-chamber design, precision made cases, non-wearing valves, and extra-long life diaphragms all combine to practically eliminate friction, prevent seepage and insure faultless metering.

For complete details consult your Sprague representative.

The Sprague No. 175 is a good-looking Standard Domestic Meter of proven dependability. Small in size — Big in Capacity, it is accepted everywhere for its sustained accuracy, extended service, and low maintenance cost. Available in Iron Case or Aluminum Case. Sizes from 175 to 1,000 cu. ft. (Synthetic or leather diaphragms in sizes 175 & 240.)

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